NATURE MAGAZINE

ecember, 1945 35 Cents Vol. 38, No. 10

SEVENTY-TWO AMERICAN BIRD SONGS

ON PHONOGRAPH RECORDS

American Bird Songs

These Phonograph Bird Song Records are from the Laboratory of Ornithology, Cornell University. They were recorded in Native Wilds by the Albert R. Brand Bird Song Foundation.

SIX DOUBLE-FACED RECORDS IN AN ATTRACTIVE ALBUM

$6.00 Postpaid

THE PROCESS OF RECORDING

These recordings were all made in the birds' natural haunts. The scientists used a sensitive microphone at the focal point of a three-foot parabolic sound-reflector which was aimed, like a gun, at the singing bird. The sound waves thus intercepted were transformed by the microphone into electrical impulses, much amplified in a sound-truck, and then used to vibrate a delicate galvanometer on which was fastened a tiny mirror. A slender beam of light shining on this vibrating mirror was deflected to a 16-millimeter film which passed from one magazine to another at a constant rate of speed. Thus the bird's song was photographed so that the image or sound-track developed on the film could be used in a reverse process and made to reproduce the song, which was then, in the laboratory, recorded on a phonograph disk.

The bird's song had to be amplified several thousand times. That means that extraneous sounds, such as wind in trees, running water, airplanes, farm machinery, and notes of other birds were amplified too. For that reason many promising attempts at recording proved failures. The songs here recorded represent the best results of many efforts.

YOU GET 72 BIRD VOICES ON 12 RECORD SIDES

Each Song Introduced and Identified

Birds of the Northwoods

No. 1 A	*No. 1 B*
1. Olivebacked Thrush	1. Scarlet Tanager
2. Veery	2. Rose-breasted Grosbeak
3. Wood Thrush	3. Slate-colored Junco
4. Hermit Thrush	4. Yellow-bellied Sapsucker
5. White-throated Sparrow	5. Alder Flycatcher
6. Whip-poor-will	6. Olive-sided Flycatcher

Birds of Fields and Prairies

No. 4 A	*No. 4 B*
1. Bobolink	1. Prairie Horned Lark
2. Meadowlark	2. Savannah Sparrow
3. Western Meadowlark	3. Lark Sparrow
4. Vesper Sparrow	4. Killdeer
5. Field Sparrow	5. Spotted Sandpiper
6. Red-winged Blackbird	6. Burrowing Owl

Birds of Northern Gardens and Shade Trees

No. 2 A	*No. 2 B*
1. Song Sparrow	1. Chickadee
2. Robin	2. Wood Pewee
3. Catbird	3. Chipping Sparrow
4. Baltimore Oriole	4. Red-eyed Vireo
5. Yellow Warbler	5. Yellow-throated Vireo
6. Flicker	6. Warbling Vireo

North American Game Birds

No. 5 A	*No. 5 B*
1. Ruffed Grouse	1. Gambel's Quail
2. Bob-white	2. California Quail
3. Wild Turkey	3. White-winged Dove
4. Dusky Grouse	4. Woodcock
5. Prairie Chicken	5. Canada Geese
6. Chachalaca	6. Mallard Duck

Birds of Southern Woods and Gardens

No. 3 A	*No. 3 B*
1. Indigo Bunting	1. Mockingbird
2. Pine-woods Sparrow	2. Brown Thrasher
3. Pine Warbler	3. Cardinal
4. Orchard Oriole	4. Summer Tanager
5. Yellow-breasted Chat	5. Chuck-will's-widow
6. Carolina Wren	6. Barred Owl

Birds of Western North America

No. 6 A	*No. 6 B*
1. Wren Tit	1. Lazuli Bunting
2. California Thrasher	2. Blue Grosbeak
3. Nuttall's Sparrow	3. California Shrike
4. Fox Sparrow	4. California Purple Finch
5. Western Tanager	5. Plumbeous Vireo
6. Black-headed Grosbeak	6. California Woodpecker

★

These Bird Songs are supplied as a service to amateur and professional naturalists. They make an ideal year-round gift and are a valuable addition to nature libraries.

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THE AMERICAN NATURE ASSOCIATION

1214 SIXTEENTH ST. N. W., WASHINGTON 6, D. C.

Charles Whitney Gilmore

Charles Whitney Gilmore, Curator of Vertebrate Paleontology of the Smithsonian Institution, passed away on September 27 after a brief illness. His death is described by Dr. Alexander Wetmore, secretary of the Smithsonian, as a serious loss to science. His passing will be equally a severe loss to many who knew and loved him.

Dr. Gilmore had been a member of the Scientific Consulting Board of the American Nature Association and *Nature Magazine* for more than twenty years. We recall taking to him a fossil bone sent in to us from South Dakota for identification. He took one seemingly casual look at it and said that it was the second joint of the foreleg of a prehistoric buffalo. "Came from South Dakota, didn't it?" he asked. He was ever a gentle but careful critic of articles within his field when they were submitted for his consideration by the editors.

Born in Pavilion, New York, seventy-one years ago, Dr. Gilmore was graduated from the University of Wyoming. After serving as a collector for the Department of Vertebrate Paleontology of the Carnegie Museum, he came to the United States National Museum and the Smithsonian. He had been associated with its great collection of prehistoric bones for forty years. He specialized in extinct reptiles, and made many field trips in search of them. Dr. Gilmore was a member of several scientific societies, a member of the Explorer's Club, and the author of popular and scientific papers.

Jackson Hole

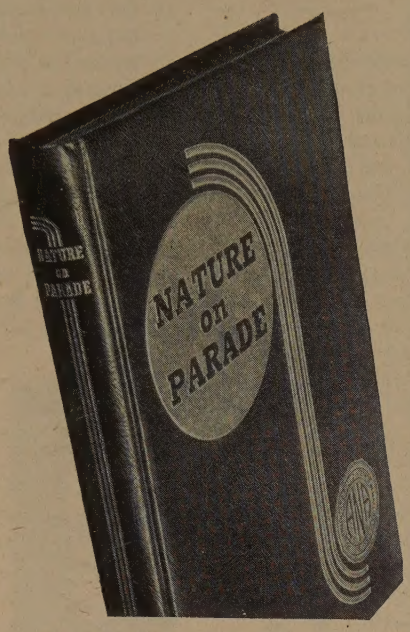
The factual and unbiased story of Jackson Hole National Monument is presented in a concise little booklet entitled "Jackson Hole", published by the Izaak Walton League of America. Presented in question and answer form, this pamphlet is of interest to all conservationists, and to anyone interested in the preservation of this area or the controversy that arose with relation to it. The information in the booklet is published by the League with the concurrence of The American Planning and Civic Association, The American Wildlife Institute, The Emergency Conservation Committee, The National Parks Association, The Wildlife Society and The American Nature Association. Copies will be sent on request to Conservation Department, American Nature Association, 1214 16th St., N.W., Washington 6, D. C.

A Lot of Glass

Nearly five million pounds of optical glass were produced by the Bausch and Lomb Optical Company, major supplier of optical instruments to the Army and Navy, between Pearl Harbor and VJ Day.

NATURE ON PARADE

VOLUME NUMBER TWO)



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1214 16th St., N.W. Washington 6, D. C.

Nature in Print

By HOWARD ZAHNISER

ANYONE with an intended Christmas beneficiary living near the Great Lakes should have a rather simple gift problem now that the Bobbs-Merrill Company has completed its first American Lakes Series under the editorship of Milo M. Quaife. To the earlier volumes *Lake Huron, Lake Superior,* and *Lake Michigan* by Fred Landon, Grace Lee Nute, and Milo M. Quaife himself, there have more recently been added *Lake Ontario* by Arthur Pound and the final volume *Lake Erie* by Harlan Hatcher. Even those living at a distance from these great inland seas will value these volumes, and if it would seem more appropriate for such friends to receive a single book dealing with the entire chain of lakes they can be the happy recipients of the Oxford University Press's publication by Harlan Hatcher entitled *The Great Lakes.* No past Christmas has afforded book buyers such an excellent choice of new works on what men have been doing in one great geographical area.

It is remarkable to a reader of the superb quintet of volumes in the American Lakes Series that Dean Hatcher could, as his publishers say, hold the story of all the Great Lakes "within the compass of a single volume," yet for the Oxford University Press he has done so, very well. In nineteen chapters comprising Part I, Discovery, and Part II, Conflict, he tells the geological and early French, English, Indian, and American history of these lakes, which, he says, "are not so much a region as an area, they are not local but international." In Part III, Possession, which is concerned with the times during which two nations have boasted of an unfortified boundary, he writes descriptive narrative chapters entitled "Lake Towns and Steamships," "Waterways to the Great Lakes," "Fur," "Sails," "Bound East for Buffalo," "Passenger Steamships," "Great Lakes Melting Pot," "Timber," "River of Gold" (which is grain), and "Fish and Fishing Fleets." His concluding Part IV, Development, is made up of chapters on "Keweenaw, Marquette, and the Sault," "Duluth and the Vermilion Range," "Mesabi," "The Ore Fleets," "Parade of Ships," "White Hell," "World War II and the Deep Waterway," and "Cities on the Shoreline." His volume is an ample justification of his introductory statement that "these lakes with their interconnecting waterways, and with the St. Lawrence linking them directly with the sea, join together two thriving nations and create one of the most diverse and fascinating regions to be found on the globe."

This diversity and fascination are even more fully experienced by the readers of the American Lakes Series—diversity in the series and fascination with the detailed accounts and wealth of incident in each volume. Perhaps Arthur Pound's volume on *Lake Ontario* would be the best of all the five for an introduction to the series, for its paramount interest seems historical. Its illustrations include a remarkable collection of portraits of historical characters and reproductions of old-time scenes. What an easy roadbed it lays for New York and Ontario residents to travel in their journeys through the history of their home land. And one of its chapters, "Iroquois Rule the Waves," though dealing historically with a "savage" people, might well be read throughout the world with timely value today. "We shall now combine our power into one great power which is this confederacy," declared the Five Nations, in a constitution transmitted orally for three centuries, and then recorded by white men, "and we shall therefore symbolize the union of these powers by each nation contributing one arrow, which we shall tie up together in a bundle, which when it is made and completely bound together, no one can bend or break." Arthur Pound has nicely headed each of his twenty-five chapters with an appropriate quotation of verse or eloquent prose, and at the head of this chapter he places Benjamin Franklin's astute observation: "It would be a very strange thing, if Six Nations of ignorant savages should be capable of forming a scheme for such a union, and be able to execute it in such a manner, as that it has subsisted ages, and appears indissoluble, and yet that a like union should be impracticable for ten or a dozen English colonies, to whom it is necessary and must be more advantageous, and who cannot be supposed to want an equal understanding of their interests."

Benjamin Franklin's insinuations have a world-wide application now, yet even in the times of which Arthur Pound writes historically, and in which Franklin spoke wisely, it is plain to see that peace was more than a domestic achievement. As Dean Hatcher observes in *Lake Erie* in his dealing with history: "The War of 1812 was a melancholy affair. It was largely the result of these world-wide conflicts which have been disturbing us on Lake Erie."

Dean Hatcher's *Lake Erie* is not as predominantly historical as Arthur Pound's *Lake Ontario.* As Milo M. Quaife tells in his editorial introduction of Harlan Hatcher: "Although strongly inclined in his earlier years toward history as the field of his scholarly specialization, he finally settled upon literature. . . . His knowledge of Lake Erie is encyclopedic, and his mastery of literary art enables him to impart it in effective and entertaining language." Perhaps it is to this that I have owed my special enjoyment of *Lake Erie,* although it may also in part be explained by the fact I once lived in the Pennsylvania triangle that borders on Lake Erie. "Largely through the efforts of Benjamin Franklin, who termed the lake 'the Mediterranean of the New World'," says Dean Hatcher, "Pennsylvania paid $151,000 for the triangle," and got a very good bargain for its money." Perhaps in liking *Lake Erie* particularly well I merely am experiencing the great appeal that each of the American Lakes Series has for those in the region with which it deals. Yet, also, I value it at my present distance more highly than any of the other volumes in this series, except Grace Lee Nute's *Lake Superior,* because it has an interest in the natural as well as the cultural history of its area. In one place, for example, Harlan Hatcher recalls that "where the ships go by at the rate of one every ten or fifteen minutes, where the buoys rock gently in the two-miles-an-hour current, and the millions of lights glitter on the water," there was a time when Antoine de la Mothe Cadillac "saw quantities of golden pheasants, quail, doves, and woodcock; and the geese and swans on the river were so thick that they draw up in lines to let the boats pass through." I may wonder a bit at this association of birds, but I am glad for an author who has them in mind. I appreciate, too, Dean Hatcher's interest in the Franz Theodore Stone Laboratory on Put-in-Bay, and the scientific studies of the ecology of Lake Erie. It is good to read his words: "The labors of these scientists and their findings are as exciting as a ten-pound bass on the end of a line off Rattlesnake Island. And they give a direct challenge to the citizens who have made the Lake Erie shore one of the marvels of the industrial world." It is good, too, to see that Jack Miner, who earned fame by giving sanctuary to waterfowl, is more honored with space in *Lake Erie* than industrial magnates. "The most famous and most frequently visited spot on the north shore of Lake Erie is a 400-acre farm near Kingsville," writes Mr. Hatcher, and he proceeds to explain this in a seven-page account of Jack Miner and his work.

It is the best of many accounts of Jack Miner that I have read, and it contributes much to this volume—a volume that also touches upon needs for soil conservation and discusses at some length the problems of the fishermen.

Each volume in this series, as its editor points out in one of them, is "the story of the lake in its human and historic setting." It is wrong, of course, to expect any book to be something that its editor and writer have not intended. We who are particularly concerned with the outdoors can be especially grateful for books that do deal with history and culture in terms of lakes and rivers and mountains. We can be glad that the Bobbs-Merrill Company, having so successfully completed the Great Lakes series, has already in preparation other, similar volumes—on the Great Salt Lake, Lakes Champlain and George, and Lake Pontchartrain. Yet perhaps we can also hope that more attention can be paid to fauna and flora and the environment of Nature than is likely to be paid by historians unprompted by naturalists. Harlan Hatcher has in part demonstrated how this can be done, and Grace Lee Nute did it, even more effectively, in *Lake Superior*. We can hope that future authors likewise can find ways of dealing with natural scenes without forgetting the nature of the scene. There is such a wealth of publication ahead in terms of geography that any efforts to make this more than cultural geography will be worthwhile.

The Great Lakes. By Harlan Hatcher. New York, London, and Toronto: Oxford University Press. 1944. 384 pp., with 17 photographs on 9 plates, 5 text maps, front end-paper map showing routes of discovery, back end-paper map showing main shipping lanes and lake ports today, bibliography, and index. $3.50.

Lake Erie. By Harlan Hatcher. Indianapolis and New York: The Bobbs-Merrill Company. 1945. 416 pp., with 33 photographs on 22 plates, front end-paper map of Lake Erie, back end-paper map of the Great Lakes, bibliography, and index. $3.50.

Lake Ontario. By Arthur Pound. Indianapolis and New York: The Bobbs-Merrill Company. 1945. 384 pp., with 42 photographs and 22 plates, front end-paper map of Lake Ontario, back end-paper map of the Great Lakes, bibliographical note, and index. $3.50.

Pacific World Series

Reptiles of the Pacific World. By Arthur Loveridge. New York. 1945. The Macmillan Company, 259 pages. $3.00.

Plant Life of the Pacific World. By Elmer D. Merrill. New York. 1945. The Macmillan Company. 295 pages. Illustrated. $3.00.

Received together, these two additions to the Pacific World Series of books prepared under the auspices of the American Committee for International Wild Life Protection may well be reviewed together. End of the war against Japan does not mean a loss of interest in the flora and fauna of the Pacific region. Indeed, it may well enhance it, since men and women returning from the area will, in many cases, do so with a lively interest in the things they have seen. Those still on duty there will have greater opportunity to pay attention to the natural life about them, and new service people will be going out to relieve those long on duty. American attention will long be directed toward this area and what it contains, making these two volumes, and their companion books, of permanent value and interest. For the authors of these books the sponsoring committee turned to Harvard University, choosing Dr. Loveridge of the Museum of Comparative Zoology for the reptile book, and Dr. Elmer D. Merrill, Director of the Arnold Arboretum and Arnold Professor of Botany at Harvard. The latter has studied Pacific flora for forty-two years, and lived twenty-two years in the Philippines, exploring and collecting widely in the region. R. W. W.

Gardener's Almanac

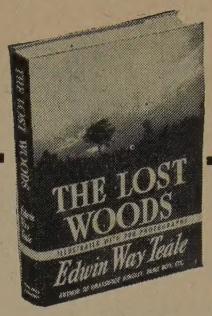
The Gardener's Almanac. By Edward I. Farrington. New York. 1945. Oxford University Press. 146 pages. $1.50.

This is a fifth and revised edition of a most popular garden book, first brought out by the Massachusetts Horticultural Society, of which the author is Secretary, in 1939. Divided by months, it lists briefly and tersely the things that the gardener should do month by month. It is a sort of daily reminder of tasks that should be performed to assure garden success, and it provides a means to look ahead and plan garden time in advance.

Compost Gardening

Pay Dirt. By J. I. Rodale. New York. 1945. Devin-Adair. 242 pages. $3.00.

The author of this interesting book is editor of the magazine *Organic Gardening*, and protagonist of new views of farming and gardening. A growing body of students of crop production support the view that the soil should be treated as Nature intends; that its fertility should be restored naturally and not through chemical fertilizers. These last, it is held, may encourage growth but, at the same time, destroy essentials that are inherent in the soil and that can be restored to it by Nature's processes. Mr. Rodale's discussion is based upon actual practice, and upon extensive study of what has been and is being done. "A revolution in farming and gardening is in progress all over the world," says Sir Albert Howard, English agriculturist, in a foreword. And this book is a chart of that revolution; a discussion that should stimulate and inform farmers and gardeners. R. W. W.



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To Stimulate Public Interest in Every Phase of Nature and the Out-Of-Doors, and Devoted to the Practical Conservation of the Great National Resources of America

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But how much are we willing to do about it?

Are we willing to pay for bringing them back? If we are, we'll buy *extra* Bonds in the Victory Loan.

And after these fellows get home—these men who have fought and won the toughest war America has ever known—what then?

We want to take care of the injured ones, of course. We want to see that the young fellows who went off to fight get a chance to finish their education. We want to see that there are jobs—plenty of decent jobs—for the men who've been doing the world's meanest job at army pay.

How much are we willing to do about that?

If we're really serious about wanting to see that our men get what they have so richly earned, we'll buy *extra* Bonds in the Victory Loan.

Now's the time. Let's have a show of hands—with wallets—to prove how much we really want to hear that old familiar step and that familiar voice yelling "It's *me!*" Let's prove, with pocketbooks, that we can do our job as well as they did theirs.

THEY FINISHED THEIR JOB—

LET'S FINISH OURS!

VICTORY LOAN

AMERICAN NATURE ASSOCIATION

This is an official U. S. Treasury advertisement—prepared under auspices of Treasury Department and War Advertising Council

Motion Picture Contest

With its purpose to create a friendly, kindly interest in animals through motion pictures, the second motion picture contest for amateurs is announced by the American Humane Association. Six prizes totalling $300 will be awarded. Space does not permit stating the rules of the contest, which closes March 31, 1946, but the details of the contest may be obtained from The American Humane Association, 135 Washington Avenue, Albany 6, New York.

Science Talent Search

The fifth annual Science Talent Search among America's million high school seniors to discover forty students with the greatest scientific potential is now under way. Entrants will compete for $11,000 in Westinghouse Science Scholarships. The quest is open to all high school seniors, or their equivalent, in American public, private or denominational schools, and is conducted by Science Clubs of America under the sponsorship of the Westinghouse Electric Corporation. This will be the first Talent Search to be conducted in peacetime.

George R. Green Retires

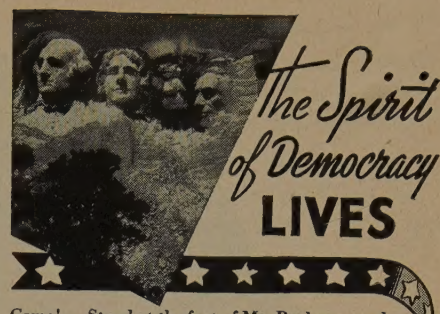
One of the pioneers of Nature education, Professor George Rex Green of Pennsylvania State College, has retired. For thirty-three years he has carried his students back to Nature by way of the classroom. In 1925 he established a Nature camp some twenty miles from the college campus, the first effort of its kind in the world. It began a long period of distinguished service, attracting a distinguished faculty and a wide following to its two summer sessions each year.

Cornell Leaflet

"Outdoor Laboratories and Teachers' Organizations" is the title of the Cornell Rural School Leaflet for Fall, 1945, Volume 39, Number 1. The primary objective of the leaflet is to emphasize the value and the opportunities for studying Nature in the field, taking advantage of the natural environment available to rural schools and other educational institutions.

Atomic Energy Report

"A General Account of the Development of Methods of Using Atomic Energy for Military Purposes under the Auspices of the United States Government, 1940-1945" is the descriptive title of a 182-page bulletin written by H. D. Smyth, chairman of the Department of Physics of Princeton University. This was prepared at the request of Major-General L. R. Groves, and is available from the Superintendent of Documents, Washington 25, D. C., for thirty-five cents.



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Contents Noted

"WITHOUT adequate clothing and other necessities of life to sustain victims of war on the long road to rehabilitation there can be no peace," wrote President Truman to Henry J. Kaiser and 7671 local chairmen of the United National Clothing Collection. This sounds the keynote of the campaign to collect one hundred million garments, and additional shoes and bedding, between January 7, 1946, and January 31, for the needy of the liberated countries. We are asked to do our part in calling these dates and this need to our readers. We hereby do so, and since Americans have never failed to heed the call of humanity in distress we see no need for going into further details. Ransack your closets, folks.

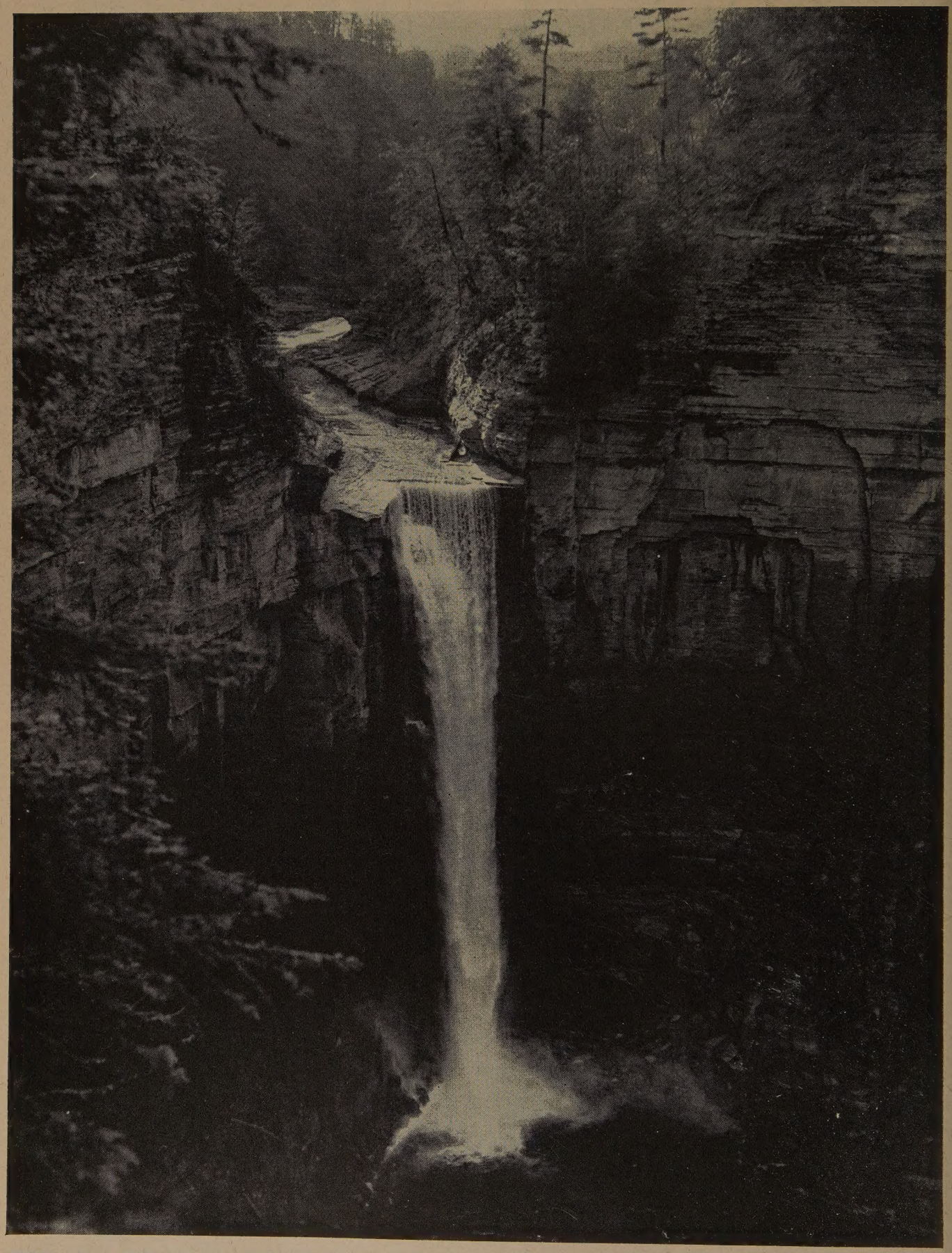
RUMORS are strange things, and the way in which they travel is often frightening, as those who have been in the armed services well know. In the Navy they are "scuttlebutt"; the Army has an even less elegant expression for them. All of which leads up to a rumor that The Everglades National Park Association has been disbanded, and that its director, Ernest F. Coe, has resigned. Mr. Coe would like it known that this gossiped interment of both organization and officers is, as Mark Twain observed of his rumored passing, exaggerated. Both are in there pitching, as they have been these several years, to save the Everglades through establishment of a National Park.

WITH the close of the year, the New York Botanical Garden ends fifty years of distinguished service, not only to the community but to the Nation. During the war it supplied trained personnel for the production of vital war products, including quinine, insecticides and rubber. It served as a training station for scientists assigned to the tropics; furnished seeds and plants for strategic war purposes; aided in the production of educational films; provided information on useful and edible plants of the tropics; lent its aid to the Victory Garden program. Indeed, an anniversary publication, entitled "The Significance of Plants in War and Peace," made possible by a friend of the Garden, is a stimulating document and a surprising one for the manner in which it reduces to terms the basic importance of a botanic garden. Too many of us think of such an institution as a place where people who like to grow plants have a fine chance to indulge themselves. Very far from it. It is to be hoped that, as the Garden begins a second half-century of service, its truly national character will be appreciated. We have often wondered how many members of the great army that visit New York each year to sightsee include the Garden in their plans. If they do not they are missing one of the most "see-able" things in the New York area.

L. HUGH NEWMAN is a Fellow of the Royal Entomological Society and a breeder of butterflies and moths who runs the only "butterfly farm" in England. He lives at Chestnut House, Wansunt Road, Cold Blow, Bexley, Kent. (We love these English addresses.) Nearby is Chartwell Manor, owned by Winston Churchill, who recently, Mr. Newman reports, came down to discuss establishing many of the rare and local species of butterflies in his grounds. The idea of stocking one's home acres with butterflies seems to us typically Churchillian. Incidentally, Mr. Newman is seeking some of our American silk-moths. Have any?

IF THE mourning dove is to continue as a game bird, sound management principles based upon known scientific findings must be applied to it, according to Frederick C. Lincoln, writing in a recent Fish and Wildlife Service bulletin. "Few birds," Mr. Lincoln adds, "exert a stronger esthetic and sporting appeal than does the mourning dove. The trim beauty of its form. the soft, delicate shades of color touched by spots of metallic luster, the whistling sound emitted by the rapid beat of wings in a swift, arrowlike flight that calls for the greatest skill of the marksman, and the soothing, plaintive quality of its call-notes, make it popular with both sportsmen and nature students." Certainly shooting such a beautiful bird cannot be justified by the few ounces of meat it provides, so the urge must come from target practice and a desire to kill something. We will take clay pigeons, thank you.

R. W. W.



White-plumed Taughannock in the Finger Lakes region, the highest falls east of the Rocky Mountains. At this spot, where the narrow, winding upper canyon emerges into the immense amphitheater of the lower gorge, lies the confluence of parallel channels of the last two glacial periods.

Lost Gorge, the outlet to Cayuta Lake, remains almost as it was at the end of the first of the two glacial periods. Sunlight and shadow patterns dance along its upper reaches where the stream remains.

Shadows of the Past

By PAUL CHURCHER

"THE rolling hills. . . .", men say; and pause in wonder, admiration and longing. There is nothing strange in this. Man follows the seas and the oceans, stands undismayed by the vast expanse of the continents' great plains, wrings existence from the most implacable deserts, but in the end, whether he be born of the hills or be brought to them, it is the hills that hold first claim on his heart-strings.

I, too, have loved the hills. I should—I spent my boyhood in that rolling region of upstate New York that maps term the Finger Lakes. A land of crested ridges and sun-touched shoulders, of blue-green lakes and winding rivers, it held much a boy could treasure. I did treasure it, every bit of it. Now, looking back, I think, perhaps, the part I valued most was not lake or hill or valley, but was, instead, the dark, pine-scented, water-fashioned gorges that the hills contained. There were many of them, and I knew them all. I knew their twists and turns, their willow thickets and hemlock-hidden mystery, the stillness of their pools, the undertones of their rapids, the bursting roar of their waterfalls. In my mind, I knew them when the first fringed-buckskin hunter pushed warily past their entrances; and before that, when the copper Iroquois stalked their deepest recesses; and before that still, when some earlier aborigines squatted in patient contemplation within

The beginning of an era. The first groping fingers of icy water reach across the headwall from the melting ice mass beyond it.

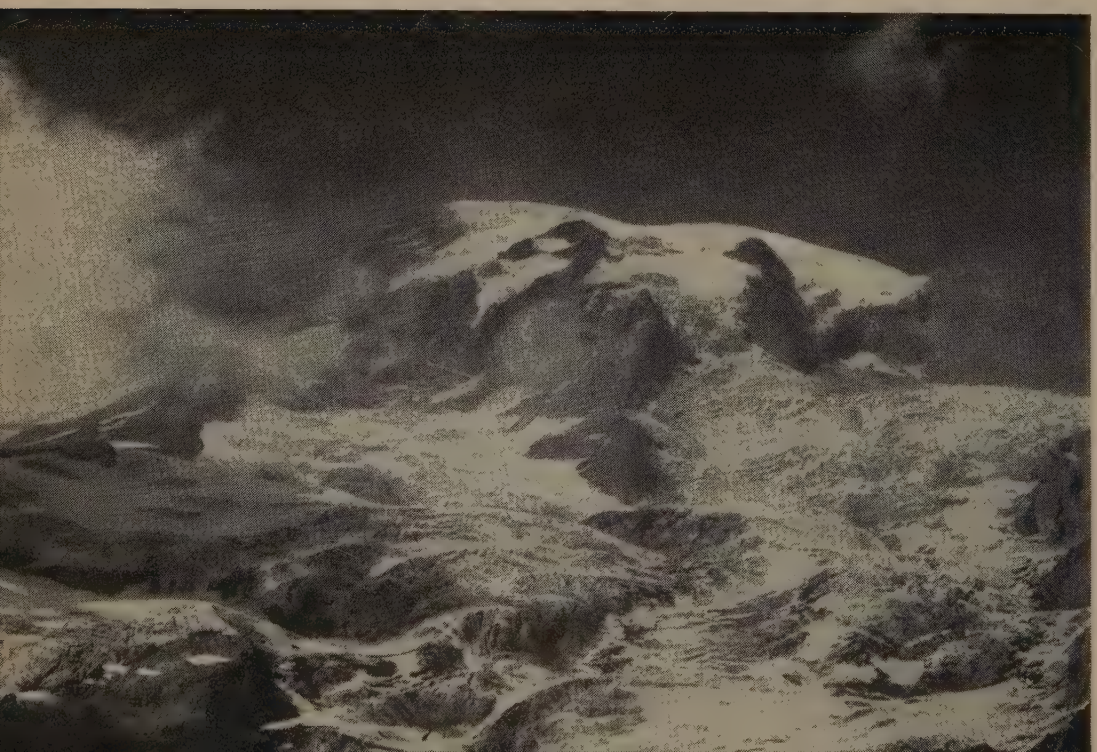
the sanctuary of their ragged and mysterious walls.

Recently I have come to know another chapter in the history of these gorges. Each dark ravine, each deep, shale-sided cleft that now exists is no more than the parallel of an earlier era. It is but the long, still shadow of older gorges, ages since lost and vanished. Upon this land, Nature once laid her hand and chose her watersheds; then departed, to return long afterward bearing an entirely new scheme of contour. These quiet glens are only second choices of the elements that shaped the topography of the area.

Hundreds of thousands of years ago when the Universe was younger, this planet now called Earth began a transformation that brought it to the stage we know today. Enclosed in the shallow film of its atmosphere, it spun unhurriedly on its axis, followed its elliptical path about the sun; advancing, as a member of our solar system, inexorably through the infinite distances of space. Day after day, month after month, year after year, the heat of the sun fell upon it and the heat of the sun was lost.

Then, for some reason, the climate changed. Perhaps the orbit of the planet shifted, perhaps the inclination of its axis tilted, perhaps the entire solar system passed into a region of dense meteoric particles. One, or all of these, or some event not even surmised, assuredly took place.

As a result, at the beginning of the Pleistocene period, about a million years ago, a great ice sheet began to move slowly southward from its center in eastern Canada, overwhelming the northern part of this country and extending across the Ontario Basin as far southward as northern Pennsylvania. Its thickness was sufficient to cover the region's highest hills.



This uptilted picture of Mount Rainier suggests the Ice Age, when Arctic armies staged their latest continental assault.

The glacier found the north-south valleys of New York State a convenient course and its flow was concentrated in them. They were eroded over a thousand feet, placing their bottoms below sea level, and leaving them with the U-shaped cross section typical of all glacial valleys.

The tributary streams of these valleys, being at right angles to the direction of ice movement, were much less eroded comparatively. When the ice melted they were left isolated far above the lowered bottom of the main valley. Today we still refer to them as "Hanging Gorges," and admire the method by which they plunge down into the main valleys by means of waterfalls and rapids.

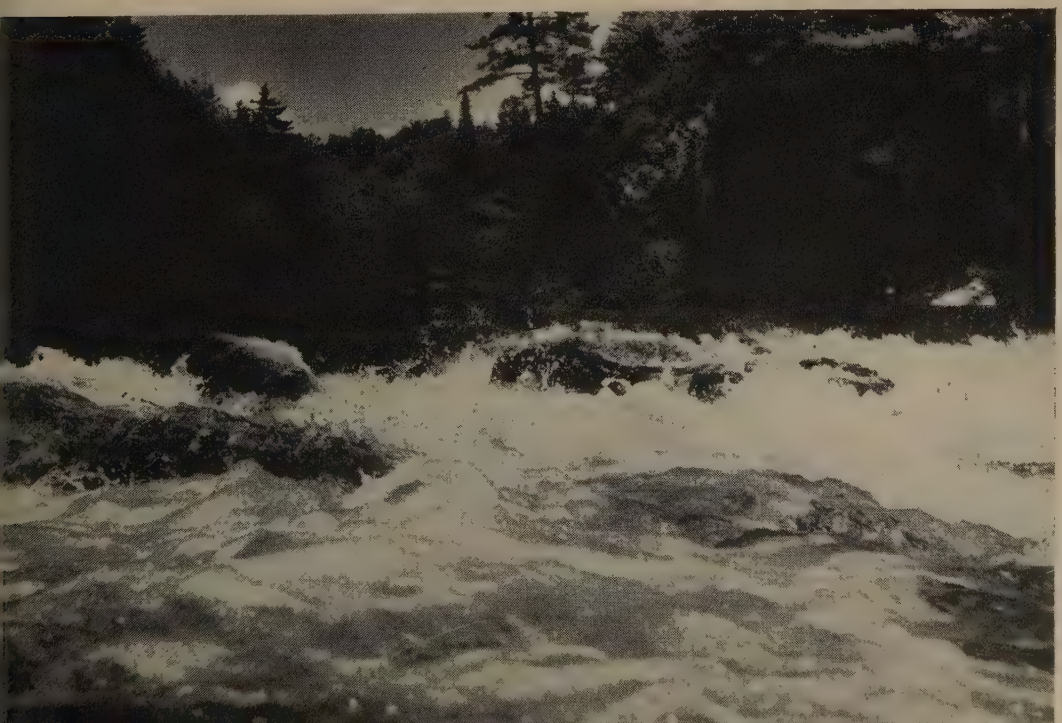
In general, the slope of the land in this region is to the north. As the ice front receded, the glacial waters were ponded between the ice to the north and the high land to the south, so that it overflowed southward into the Susquehanna River. As the ice continued to melt northward, it uncovered lower outlets there and allowed the lakes to drop to successively lower levels. At each level the incoming streams built deltas with the loose material that they were carrying. These abandoned high level deltas are called, as in the case of the gorges, "Hanging Deltas." The flat shelves on which many of the lake country villages are built were formed in this manner.

It is known that this ice age was interrupted by at least one warm inter-glacial period which was of much longer duration than our present post-glacial period. Gorges cut by the inter-glacial streams are generally broader and with more gently sloping sides than those made since the melting of the last glacier. However, the inter-glacial gorges are largely filled with glacial till left by the last ice sheet and are exposed only locally where the post-glacial streams have reexcavated them.

The post-glacial gorges and waterfalls have been formed within the twenty or thirty thousand years since the last ice sheet disappeared. Because the former courses were filled with moraine material, the reborn streams had to pick their way from one low point to another over the rough surface, and their beds only occasionally correspond to the inter-glacial gorges. The lines they follow are the ones we know today.

There are few exceptions. A few smaller streams in sheltered places reopened their original outlets. Several carved their new channels so closely parallel to the old that old and new intermingled, resulting in an alternating condition of broad amphitheaters connected by narrow canyons. One, the outlet to Cayuta Lake, called Lost Gorge, remains almost as it was at the end of the inter-glacial period. The second advance of the glaciers blocked off its upper entrance and flowed around it, but did not refill it. It remains the only inter-glacial gorge of this area.

The Earth moves on. The rains fall and the streams hurry down through dark ravines to the sea, and you ask, "Does all this matter?" No, not to you and me. Not to our generation. Nor to our ancestors, nor to our children yet unborn. The gorges are here. They were here before any of us came. They will remain here when all of us have departed. Cool on summer mornings, storm-flayed on winter nights, they are ours to cherish or ignore. Still, sometimes wandering through them, thinking of the faint shadows they have left upon the land nearby, I am conscious of both the fossiled breath of antiquity, the raw expectancy of the future. These sharp, gaping slashes into the hills are old; the scars of an earlier existence are older yet. And I wonder if there are other scars that we will never discover; if the present gorges will themselves become scars, if the ones which follow them will also fade to scars. I might at least go out and tack up little signs marked "Here" and "Here" and "Here" to aid the quest of some future dreamer seeking the story of the past.



One of Nature's sculptors at work. The white water of a rain-swollen stream breaks forth from the dark-mantled hills.

Wee Tim'rous White-Foot

"One bitter January Sunday in the woods, we came upon a little, furry, mouse-size creature sitting half frozen in a spice bush. It was just sitting there. . . . Plainly some enemy had driven her out of nest and home, and she had courageously taken her young along. . . . Why had she fled into the open and climbed a bush?"

By WILLIAM BYRON MOWERY

Illustrated by Walter A. Weber

One bitter January Sunday in the woods, we came upon a little, furry, mouse-size creature sitting half-frozen in a spice bush. It was just sitting there.

Its big ears and bright fawn color told us it was a White-Foot, and we wondered why on earth this nest-loving, nocturnal animal was perched in a bare bush in ten-below-zero weather, on a dazzling white day.

Its queer behavior was all the more a mystery to me because I had known White-Foot so long and well. A friendly, dainty little thing, it is one of the commonest wild creatures of our woods and fields. Farm boys everywhere know and like the intelligent little rascal, and give it a special place, as with the cardinal among the birds. It is not merely harmless; around sheds, gardens and groves it is highly useful.

Our first guess was that hunger had driven this White-Foot out to forage. Some Promethea moth cocoons dangled from the spice twigs, and moth grubs, including several injurious species, are an item in the White-Foot's diet. But then we were surprised to see that this White-Foot had four half-grown young clinging tightly to her, and we knew she would never have burdened herself with nestlings on a food hunt.

Plainly some enemy had driven her out of nest and home, and she had courageously taken her young along. But why had she not sought safety in some dark niche of her feeding grounds, in the White-Foot way? Why had she fled into the open and climbed a bush? Answers to such questions do not come easily.

There were no weasel prints in the inch of snow, or enemy signs of any kind, and we decided to look into this mystery.

But first, White-Foot had to be given a hand. Cold, homeless and burdened by the four young, she was in a bad fix. As we eased close, she sat quiet, merely twitching her nose at us. When we presented her with the open end of a wool mitten and nudged her with a twig, she crept into the warm, dark haven quite readily.

I tied the mitten shut and put the beasties in my pocket, to take home—mostly because I did not know what else to do with them. Certainly I had no foreknowledge of the odd tricks they were to show us, or the fascinating glimpses they gave us into the ways of all animals that flee instead of standing and fighting. Also, I felt I had long owed the White-Foot tribe a debt, reaching back to boyhood days on a hill farm. Often in winter I would come to a rabbit den, all tracked up outside, and would be thoroughly exasperated to think of the four or five rabbits sitting safe and sound in the depths of the burrow. On such occasions I would hunt up and capture a White-Foot, usually at the nearest fodder shock, and put it into the den. When it went scampering back in, the rabbits would think it was some kind of a miniature weasel, and without caring what kind, just so it was a weasel, they would come boiling out of there bug-

eyed because of the intrusion.

With White-Foot safe in pocket, we backtracked her to where she had come up out of a run, and by following this run a few feet we found her nest, at the base of a small stump. Considerably larger than a double fist, the nest was warm, dry and well constructed. The outer layer was of cedar bark stripping to shed the weather, the bulk was of grass, and the lining was the downy fuzz from sycamore balls.

". . . gave White-Foot a shred of coconut. She ate it at once, and then took a second one from the fingers. Mind you, this was a wild creature half an hour after her capture."

At the nest we found no trace of the unknown enemy; or of a mate, anywhere. This latter was surprising. Almost always the White-Foot is found in pairs. The union is one of the closest I know of, and my observations lead me to believe it is permanent.

From our White-Foot's nest several runs led out to her nibble gardens. By uncovering these runs we found the enemy at last. It was a shrew.

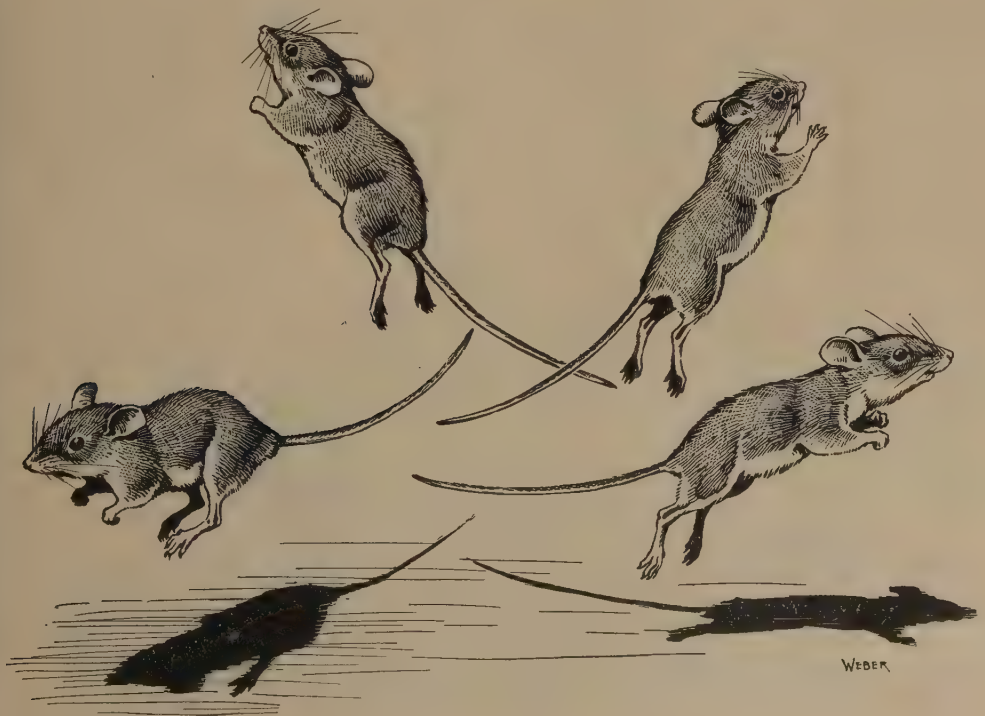
Although shrews are fairly common, they seldom appear in the open and are usually mistaken for mice, so a few words about them here may be in order. The shrew is no rodent at all but an insect-eater, and it comes from the same ancient stock as the monkeys. It can be distinguished from the mouse by its long, fleshy snout and its hand-like foot and digits. The American pigmy shrew is the tiniest mammal that ever lived. It is no bigger than a good-sized peanut.

The shrew is an incredibly high-strung bundle. Holding one in the hand is like holding a wad of electricity. But its outstanding feature is its incredible appetite. A shrew will kill a mouse of its own size with one explosive onset and eat it on the spot. I have had several shrews, including Florida pigmies, in the observation cage, and the amount they eat is downright fantastic. Like the ground mole they will die in a few hours if deprived of food.

We could reconstruct White-Foot's story easily enough. When the shrew entered her home grounds, she had packed up and fled at the first whiff of the musky intruder. From long racial experience of her kind with the shrew tribe she knew that the voracious shrew would follow and kill her if she stayed anywhere under cover, and that she could save herself and young only by the extreme measure of fleeing into the open and climbing a bush.

That was why we found a White-Foot perched in a bare spice in ten-below weather, on a dazzling white morning in the middle of winter.

At home we emptied the mitten on the living-room rug and sat around to watch, keeping quiet and a few feet away. White-Foot could have dragged her young off to a dark corner, but oddly she was not a whole lot afraid of us big Brobdingnagians. She would rise up kangaroo-like and sniff at us,



"Suddenly, and for no visible reason, they would all give a jump, all four at the same instant, and then they would be somewhere else. The word 'jump' poorly describes the flash-like quickness of their move. It was too quick to follow."

then fall to licking the human taint from her four fuzzies, but she made no attempt to flee.

We had leisure now to examine her more closely. There are *seventy* different species of White-Foot in America, with certain variations in size and color, but the type description holds for all, with no need to split hairs. The White-Foot has soft fine fur and white feet, paper-thin ears, and the large, shoe-button eyes typical of any nocturnal creature. The fawn-colored back and sides are set off by a sharp line from the pure-white throat and belly. This protective pattern of darker above, lighter below, extends even to the birds of the air and the fish of the sea. With White-Foot the pattern is given an extra twist—the tail also carries out this two-tone scheme. It is fawn-colored above and white below clear out to the tip hair!

After a while one of us reached out carefully and gave White-Foot a shred of coconut. She ate it at once, and then took a second one from the fingers. Mind you, this was a wild creature half an hour after her capture. It illustrates the native tameness and camaraderie of this little thing. In my book the White-Foot is the most easily tamed of all American animals, and it also makes one of the most alert, likeable pets.

We saw that White-Foot was famished, what with herself and the four nestlings to eat for, and we presented her with a feast of almond, cornbread and more coconut. She ate mannerly, taking small nibbles and pausing to lick her paws, but she kept at it steadily.

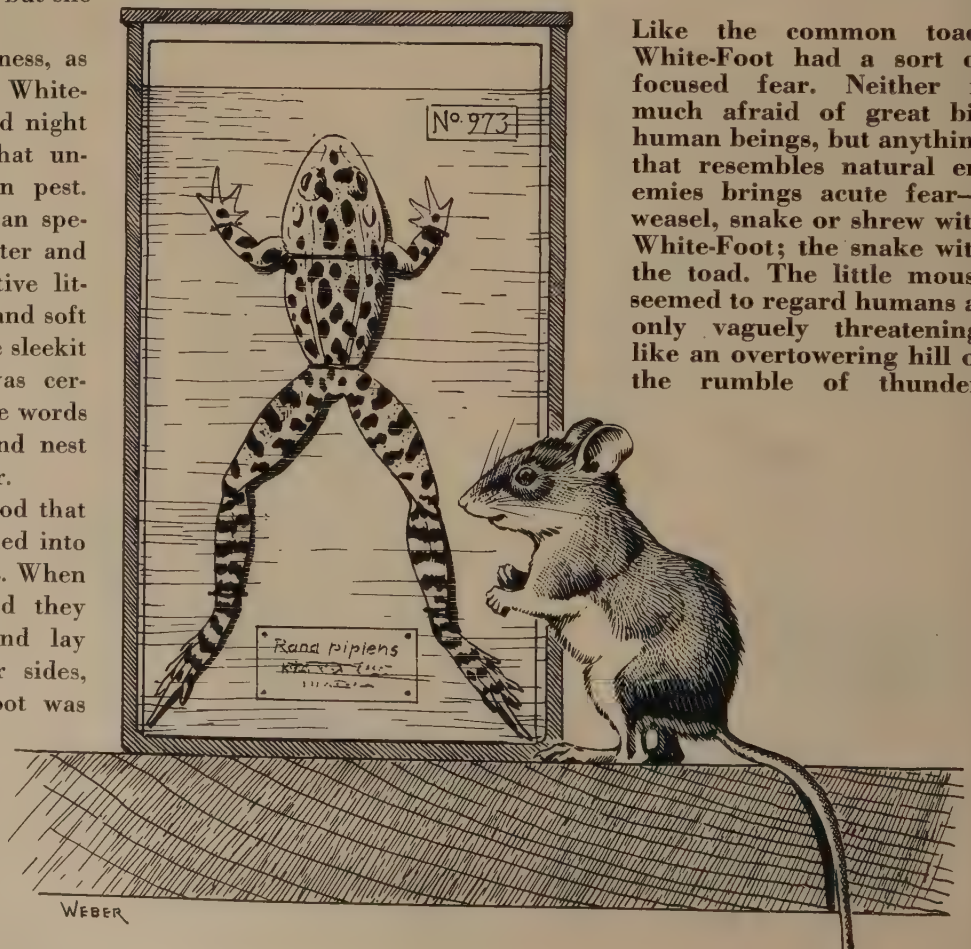
In its daintiness and cleanness, as in so many other respects, the White-Foot is as different as day and night from the domestic mouse, that unclean and destructive foreign pest. Nearly all our native American species, like the jumping, harvester and grasshopper mice, are attractive little animals, of amusing ways and soft sleek fur. The celebrated "wee sleekit beastie" of Burns's poem was certainly no domestic mouse. The words "sleek it" and its underground nest suggest that it was a harvester.

In a very short time the food that White-Foot ate was transformed into sustenance for the four fuzzies. When they got completely surfeited they dropped off one by one and lay around on the rug on their sides, sound asleep. Now White-Foot was free and could have streaked for a dark corner, but she merely retreated into the mitten, refusing to abandon her young and also showing oddly little fear of us. So little fear, in fact, that we were puzzled and ran a few simple experiments on her, while the fuzzies were asleep, to get a line on her flight instincts.

We discovered that she was much more afraid of the human hand than of the whole human. Also, when a person walked past her at a distance of five feet she was much less alarmed than when a clothesbrush was dragged across the floor at a distance of five feet. A rough explanation of all this was that we humans were *too* big for her to comprehend very clearly as foes. In Nature her chief enemies were weasel, snake and shrew, and her escape instincts were rather sharply tuned to foes of that size. To her we were only vaguely threatening, like an overtowering hill or the rumble of thunder.

A fine example of this sharply focused fear can be seen in the common toad. When we roust out a toad, he is not much afraid of us; he may take a few hops but that is all. But put a stick or hoe handle down on the ground and slide it toward him, simulating his chief enemy, the snake, and he will light out for the next county.

We fixed up a cage for White-Foot and the four fuzzies, although they spent more time out of it than in it. In a few days White-Foot was tame enough to be taken into the hands and fed. As for the fuzzies, which grew almost visibly, they were taken over by the younger generation, and carried around in pockets and blouses. One of the four, whom they



Like the common toad, White-Foot had a sort of focused fear. Neither is much afraid of great big human beings, but anything that resembles natural enemies brings acute fear—weasel, snake or shrew with White-Foot; the snake with the toad. The little mouse seemed to regard humans as only vaguely threatening, like an overtowering hill or the rumble of thunder.

named Wouse, was supposed to have extraordinary talents, a very wonder of a mouse, although I personally could never see much difference between him and the other three. All of them were good acrobats, tame and friendly, and the equal as pets of any golden hamster, spinning mouse or such-like foreign oddity that I have ever seen.

At night we kept them in the cage, in an alcove outside my study; and as the young became nearly grown I began hearing a queer noise out of them when the house quieted down. The noise was a dull *sn-ii-pp*, repeated at about ten-second intervals and kept up almost endlessly. I tried to find out what it was by snapping on the alcove light and by sneaking up with a flashlight, but I had no luck until one night I placed the cage by a window so that the moon struck it full, and watched from behind a bookcase.

The curious antic that caused the noise went like this:

The four young White-Feet, distributed around the cage, would be sitting tense and quiet. Suddenly, and for no visible reason, they would all give a jump, all four at the same instant, and then they would be somewhere else. This sudden leap was the dull *sn-ii-pp* I had been hearing. The word "jump" poorly describes the flash-like quickness of their move. It was too quick to follow. A White-Foot would be sitting quiet on the floor and in the next instant he would be sticking up against a side or the ceiling.

It was like some outlandish backfield shift—a silent, quaintly solemn procedure. What the signal was for the shift I do not know yet, but all four jumped at exactly the same split-wink. Perhaps the signal was a squeak too high-pitched for the human ear, and perhaps it was the super-talented Wouse that gave it.

The fact that White-Foot took no part in the antic was the key which finally unlocked the puzzle for me. *The four young were playing.* However solemn and unplaylike it looked, that was what they were doing, with zest and exhilaration. The play of all young creatures is an earnest preparation for adult life. With fighting animals like the dog, cat and bear, play takes the form of cuffing and biting among the litter mates. But with fleeing animals, play takes the form of evading enemies. That was what the four young White-Feet were playing at in the cage, hour after hour—the game of "Freeze! Jump! Freeze!" In the dark night woods, with weasel, snake and shrew to elude, the difference between life and death would often lie in that expertness at being in one spot one instant and somewhere else the next.

White-Foot deserted us; one of the fuzzies met accident, and a pair were presented to friends; but Wouse, the super-duper, was with us until May.

We kept him in the cage at night, and I often took the cage into my study. His acrobatics were amusing and he was always tremendously busy at something or other—acrobatics, eating, just messing around, and making his thorough, scrupulous toilet. If I would open the cage and sprinkle a cup of birdseed on the rug, he would spend an hour, busier than a jug of bumblebees, picking up every seed and toting them to his hoard placed in the corner of the cage.

Like Mary's lamb, Wouse went to school one day—a university instructor in zoology took him to class as an animated example of protective coloration. According to all accounts, Wouse made a hit. He sat kangaroo-like on the instructor's desk, galloped along the lab table, and was photographed to show the equalization of direct light on a dark back and reflected light on white underparts. In fact, Wouse did his stuff so well that the instructor, handing him back to me, remarked disgustedly:

"That mouse with its two-tone tail taught those students more about protective coloration than I'd done in an hour's lecturing!"

Before he deserted us, undoubtedly looking for a mate, Wouse paid for his room and board with a valued service. Our big old house was so situated that we had trouble keeping it free of domestic mice. But Wouse kept it free. Whether he killed them or they cleared out ahead of him, I am unable to state, but it adds up to the same figure. I have seen this same thing happen a dozen times, and others have reported it—our White-Foot will not tolerate the common mouse anywhere around.

This is one reason—among several good ones—why the White-Foot should have our friendly protection. It is never destructive, never flocks together in plague proportions, like the lemming; and the garage or shed with a White-Foot pair in it is safe from the foreign pest. White-Foot seems the "better mousetrap."

Immortality

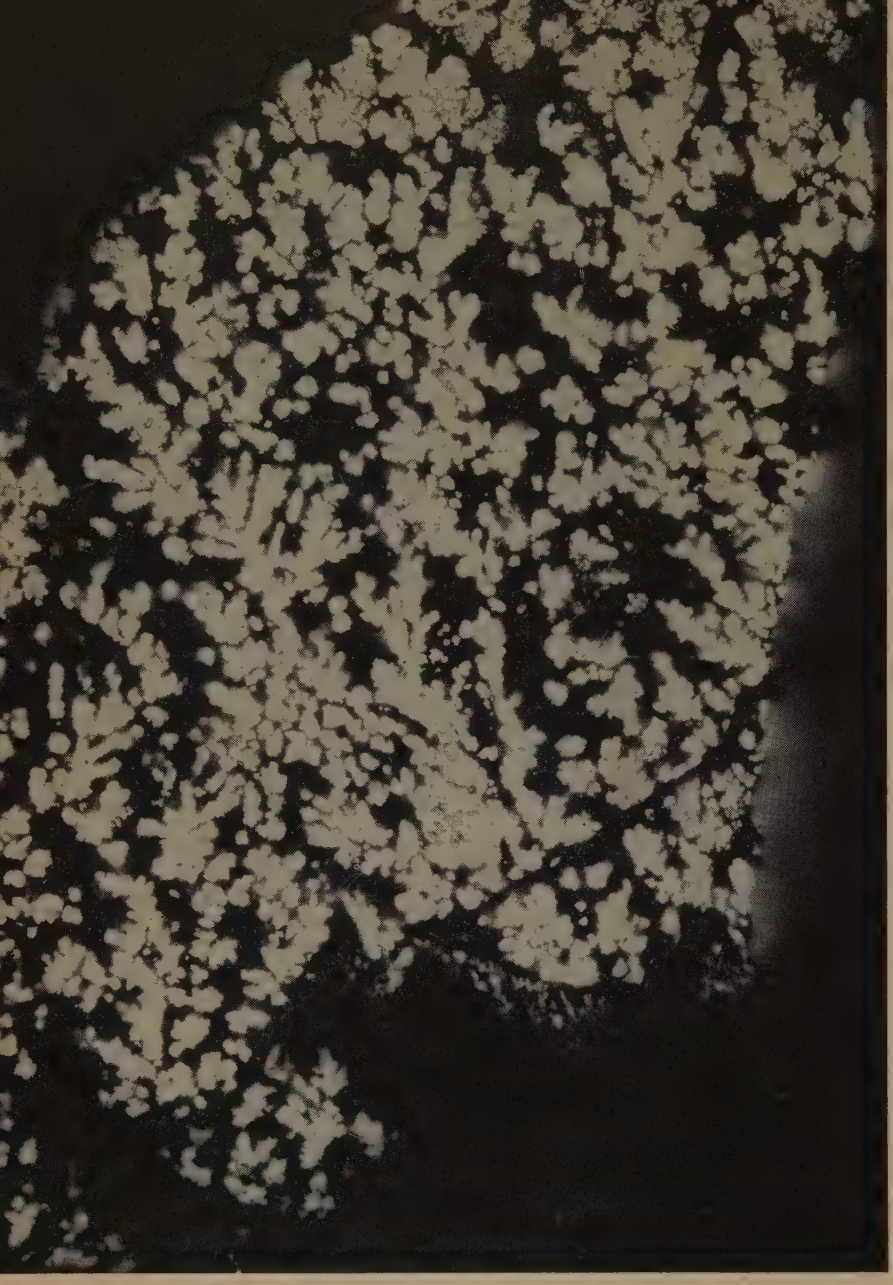
By LOUISE MAYERS MEREDITH

Dancing and gay, laughing or calm, the lake,
Reflecting Spring's new green, rich Autumn's tone,
Regarded not the fact that time would take
The breath from waves and fix them hard as stone.
Now underneath chill Winter's white ice-cake
Deep water trusts the sunrise it has known.

Maternal

By LELA M. WILLHITE

The day goes softly
To tuck in the night
With patchwork quilts
Of shadow and light.



Minerals that Take Their Own "Pictures"

By B. M. and MARY S. SHAUB

★

Autoradiograph of an unusually fine specimen of three-dimensional dendritic uraninite from the Ruggles Mine near Grafton Center, New Hampshire. This is a locality well known to mineral collectors in New England for its uranium-bearing minerals. The autoradiograph was made by an exposure of twenty-four hours, and shows the specimen natural size.

THERE are about one hundred and twenty-five known minerals that can "take their own pictures." Their ability to do this is because of a property known as radioactivity. This is a term that has become familiar to millions through the events that took place in New Mexico, and, later, in Hiroshima and Nagasaki, Japan.

This phenomenon was first observed quite accidentally, and resulted directly from the discovery of X-rays. In February, 1896, a few months after the discovery of X-rays, Henri Becquerel, a French physicist, was experimenting with the irradiation of a fluorescent substance with sunlight in order to observe an apparent effect, similar to that of X-rays, of darkening a photographic plate through black paper. He was using double sulphate of uranium and potassium as the fluorescing material. After preparing the experiment, and while waiting several days for sunshine, he discovered that even in the dark the specimen emitted a radiation that penetrated the black paper, as well as other substances, including thin sheets of metal. He also discovered that exposing the fluorescent substance to sunshine had no effect upon the phenomenon of radioactivity. It was soon found that certain rays are emitted by the uranium, and that the chemical state or temperature of the uranium does not affect the intensity of the phenomenon.

It was due to Becquerel's discovery of radioactivity that Pierre and Marie Curie sought the cause of this unusual property of the uranium compounds, both those prepared in the laboratory and uranium-bearing minerals found in Nature. Together they pursued the laborious task of analyzing, chemically, several tons of the residues of pitchblende from Joachimsthal, Bohemia, to determine if there were not an unknown chemical element in the radioactive residues —an element much more radioactive than any yet known. They were not only successful in isolating one new element, but a second was discovered. This was the very valuable and strongly radioactive element to which they gave the name *radium*, which is immensely more active than uranium. Eventually

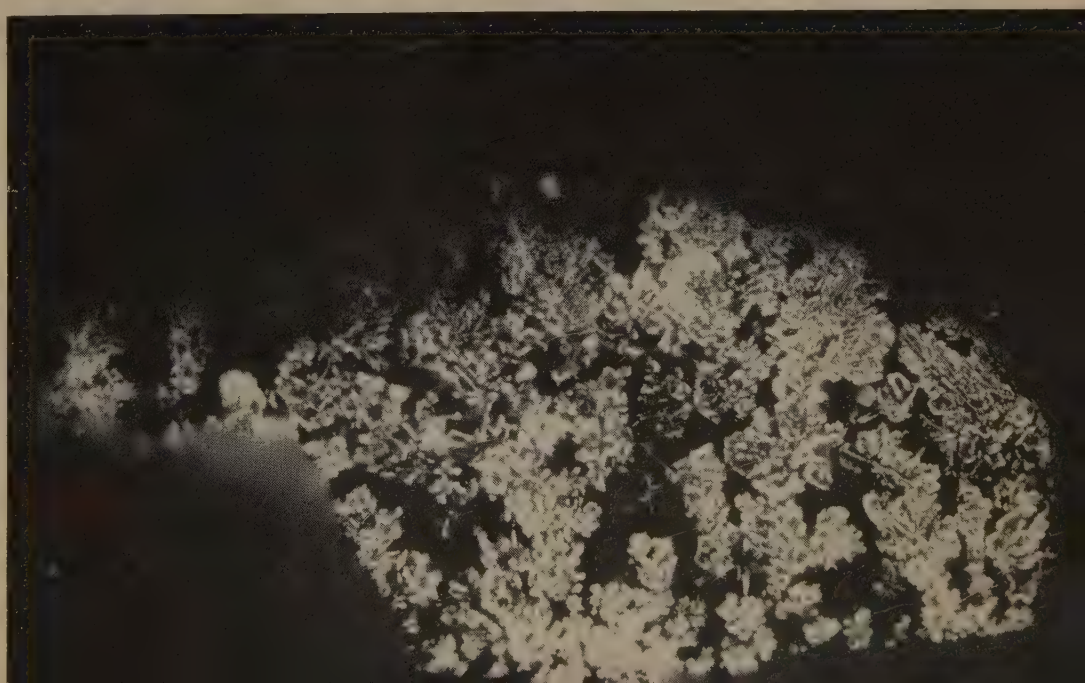
the Curies, with others, discovered that additional elements were radioactive, especially thorium, and that uranium and thorium spontaneously changed, at a definite rate, into other elements —in reality a transmutation of one element into another. It was this sort of thing that the alchemists of old tried vainly to achieve. It is also this remarkable discovery of radioactivity and spontaneous transmutation of certain elements that led to the discovery of the present methods of "atom smashing," and to the atom bomb, with its promise of the use of atomic energy.

Radiograph of a sheet lead star, 1/32-inch thick, when irradiated by emanations from a large piece of massive uraninite from the Wiseman Mica Mine near Spruce Pine, North Carolina. The exposure, twenty-four hours.

During the radioactive process of changing from one element to another, the older element emits a small particle of matter called an alpha particle. This is an atom of helium, less its electrons, propelled at a high velocity. Another type of particle is called a beta particle, which travels at a very much higher velocity. These particles quickly collide with the molecules of oxygen and nitrogen in the atmosphere, and, consequently, they can travel less than two inches before being stopped. If a strongly radioactive material is placed on a photographic plate, or film, in a dark room, the emanations, traveling at high velocities, will expose, upon impact, the photographic emulsion on the plate or film. The action even takes place if the photographic plate is securely enclosed in black paper, for some of the emissions from the radioactive substances penetrate to a considerable distance, even in such a dense material as lead.

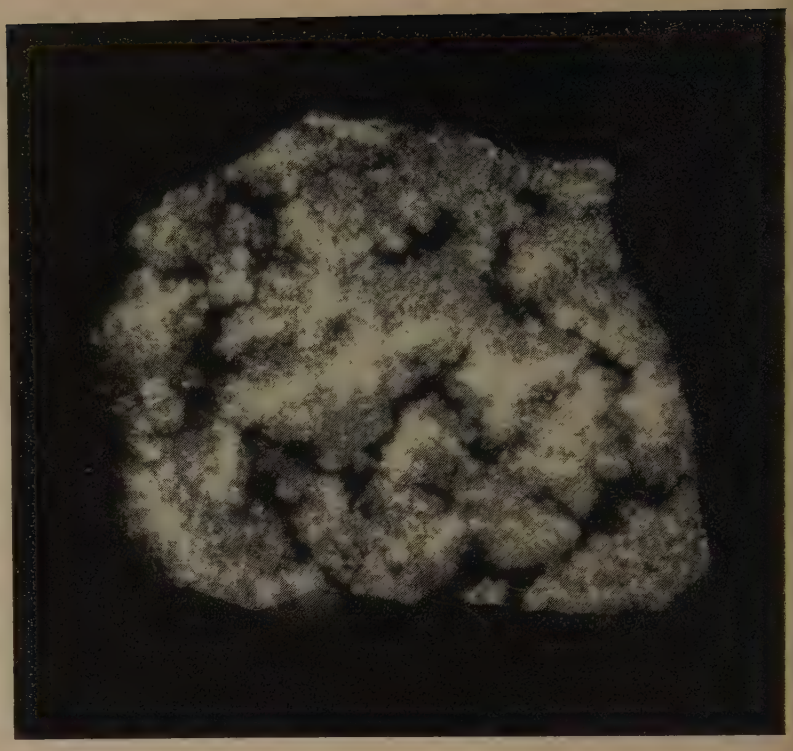
While it is interesting to know why certain things happen as they do, it is infinitely more interesting to have a "hand in the doing." For this one must first collect some of these minerals that will give a practical demonstration of this radioactive phenomenon. The radioactive minerals, with few exceptions, occur in a single type of rock known as pegmatite dikes. It is from the pegmatite dikes that manufacturers of porcelain, china, kitchen-ware enamels and some scouring powders obtain a white mineral called feldspar, which is used in the making of these products. Feldspar mines are common in the New England states, New York and the states along the eastern foothills of the Allegheny Mountains. The Black Hills of South Dakota and the mountainous states of the West, as well as Ontario and Quebec, have some feldspar mines or quarries.

Since the minerals of pegmatites are usually white, large piles of waste rock around the mines are conspicuous and indicate the location of possible places to search for radioactive minerals. After obtaining permission to search, one should, if persistent, be successful in finding several of the known radioactive minerals. In searching, one should remember that they are usually either black or some shade of orange, yellow or green. The most radioactive are the black minerals called *uraninite*, sometimes oc-



Autoradiograph of skeletonized crystals of a specimen of uraninite, with some gummite along the upper left edge. The specimen was from Ruggles Mine. In it the uraninite developed as skeletonized cubical crystals, producing many thin-walled structures, which show as fine lines in a labyrinthine pattern that cuts across the skeleton crystals. The exposure was twenty-four hours, and the picture is natural size.

Autoradiograph of cyrtolite from the Kinkle Quarry near Bedford, New York. The black areas represent parts of the specimen that contain little or no radioactive material. The areas of gray to white show a varying intensity of activity, which indicates corresponding distribution and a proportionately larger amount of uranium and thorium to produce the white areas. Exposure was for six days. Natural size.



Autoradiograph of samarskite and associated minerals from near Spruce Pine, North Carolina. The large white area represents samarskite, which shows considerable fracturing. The dark gray areas (a) represent a less radioactive mineral, while the black area (b) represents feldspar, a non-radioactive mineral. Exposure was for six days, and the specimen is shown a bit larger than natural size.

curring as well-developed cubes, and *pitchblende*, which is lacking in crystal forms. The former is found chiefly in pegmatites, while the latter is associated with metalliferous mineral deposits, and is much rarer. These minerals frequently have undergone an alteration that changes them into a brilliant, orange-colored mineral called gummite. Associated with these minerals one often finds a number of yellow, or green, flaky or powdery minerals developed in the alteration process of the uraninite or pitchblende.

All of the strongly radioactive minerals are quite heavy, some being exceptionally so. Uraninite is somewhat variable in weight; however, it is often heavier than an equal volume of copper. The great weight, and the associated minerals of brilliant yellow, orange, or green color, are the best indicators of radioactive minerals. At times the enclosing minerals have a radial fracturing about the radioactive ones, while at other times the nearby minerals are noticeably darkened by the emanations, quartz being often changed to a deep smoky color. The best and easiest way for the average person to make certain whether the minerals he may collect are radioactive is to place them on a photographic plate in a dark place and leave them there for a time that will depend upon the particular mineral. Those that are strongly radioactive, like uraninite, pitchblende and gummite, will produce good autoradiographs in 24 to 36 hours; weakly radioactive ones, like some allanites, may require 30 days (Continued on page 552)

Red-tailed tropic bird, or Bos'n bird, *Phaethon rubricauda*, on its nest with its youngster. Familiar to many who have served in the Pacific, the bird is found on islands both north and south of the equator.

The Red-tailed Tropic Bird

By LEWIS WAYNE WALKER

EVER since ornithology became a science, there have been arguments about the ability of birds to fly backwards. To date, the hummingbirds are the only ones established in the popular mind as having this ability, although king birds, burrowing owls, and sparrow and marsh hawks, and others, are known to possess it to some degree. In the decade to come the tropic birds that reside on the Pacific atolls probably will be submitted often by servicemen who saw duty on these lonely island outposts. They will aver, and with honest conviction, that they have seen these "Bos'n" birds fly backwards, and will argue that the prevailing winds were in no way responsible for what they saw. Most of the atolls are only rarely becalmed, and the wind, although it changes direction with the seasons, blows with amazing regularity at a height of fifty feet or higher.

During courtship, and to a lesser extent throughout the rest of the year, the tropic birds put on a strange aerial dance. It is never performed by singles, and rarely by two flying together. But with three birds in the air at once the dance routine is almost a certainty. However, since each bird takes its turn at flight acrobatics, the theory that "it's a couple of males showing off to some female" is evidently the wrong interpretation.

Rising from the ground with a steady wing-beat, the tropic birds will attain a height of about seventy-five feet. At this altitude they commence to circle, alternately gliding and flying until several come into a close group. The leader will then face into the wind, rise slightly into the air, and bend the two

long, red, tail-feather shafts forward under its body and hook them in place with its feet. Meanwhile its wings are beating wildly, supporting its weight while it squawks with an unpleasant, rasping voice. The wind blows the bird backward, often for a distance of twenty feet or more, before it stops this contortionist act and catches up with its fellows. When the bird comes abreast, another goes through the same procedure. Thus, taking turns, they disappear beyond the breakers.

I observed the birds in varied winds, from gales to near calms, and several facts were noted. First, the birds were never seen to do this when flying downwind. Second, on a fairly calm day they would be in reverse for only two or three feet, while on a windy day would go back twenty feet or even more. Occasionally one of the birds would commence squawking when it was at a slight angle to the wind, and its body would then drift on this angle, and not along a line drawn from beak to tail.

Most of the atoll-nesting birds have good dispositions, and do not voice strong disapproval when eggs or young are handled. The "Bos'n" birds, however, are a noisy exception to this rule, and their orange-red bills can inflict a wound without interrupting a continuous stream of apparent bird profanity. About the only way to see an egg, or newly-hatched youngster, is to pry the adult off the nesting depression with a stick.

On land the full-grown birds are clumsy, and they do not have strength enough in their legs to permit upright walking. Hence they progress across the sand like a snow plow, leaving a distinct concave trail made by the pushing breast.

When I first became acquainted with these birds I was surprised at the numbers not sporting the long, trailing, red feather-shafts on the otherwise ordinary white tail. I had about come to the conclusion that these feathers were a sex characteristic when I discovered the real cause of the shortage. About one out of every five sailors' locker boxes or sea bags contained an eighteen-inch roll of newspapers, or a cardboard mailing tube. Into these pilfered tail-feathers had been dropped, butt first. It seems that in the first days of occupation someone started the "scuttlebutt"—Navy for rumor—that these feathers were extremely valuable for use as millinery decorations. Although the authorities have tried to deny this, both on bulletin boards and in the island "paper", it still persists, and the feathers are plucked on sight. The loss of these two feathers probably causes little discomfort to the bird, and, as one Marine said to me, "It's lucky for them they ain't peacocks, or they would really have something to gripe about."

In describing the overall plumage of these birds, one would probably call them white, and most museum specimens would fit such a description. However, in life, there is a faint rosy or pinkish tinge, so delicate that it shows to advantage only in certain lights. This sheen seems to become more pronounced as the birds age, yet it fades in death.

Although the tropic birds cannot by any stretch of imagination be considered sociable, there are areas where several pairs will nest in close proximity. Whether this colonization trait existed before the human occupation is questionable. Perhaps it has been brought about by the clearing of brush-covered areas, causing concentration of birds in the remaining patches of growth. These present-day colonies usually have the nests spaced eight or ten feet apart. During the period when one parent relieves the other in the care of the rusty-red egg, battles frequently occur. The returning adult will volplane to the general vicinity of home and slide to a stop as though it had forgotten to lower its wheels. Then, like a tank, it will start pushing itself along the ground in a straight line to its waiting spouse. The birds do not seem to know the meaning of the word "detour." If another "Bos'n" bird is warming an egg in its path, it barges right on through, yet the meeting is noisy.

Boat-Tailed Grackle

By THEODORE E. KJELLSTROM

Oh, dashing knave in sable tights,
Why can't I mimic thee?
You shout, "Ker-chunk", but when I try—
You change your note to, "See?"
I pucker up, with face still flushed,
From my be-mocked, "Ker-chunk,"
And Whistle, "See?" but you, foul fiend,
Just laugh and say, "You flunked."

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Sky Umbrella

By ROSE NOLLER

A heron flew up high,
Opening his large umbrella
Against the lazuli.
And then he closed it up—a clever trick—
Among the marshes,
A crooked umbrella stick!

The Giant of Oaxaca

By R. T. HATT

A TREE, the deep, furrowed trunk of which measures forty feet in diameter, stands beside the Pan-American Highway in a sector as yet unpaved extending southward from the city of Oaxaca to Tehuantepec. It is Mexico's greatest tree, a *sabino* or bald cypress, *Taxodium mucronatum;* a tree that was a thing of wonder more than four centuries ago when European eyes first saw it. This tree, and another large specimen that the Indians call the *hijo,* or son of the greater tree, grow within the confines of the churchyard of Santa Maria del Tule, a half-hour's ride south of Oaxaca and within that state.

Mexico's greatest tree, the ancient bald cypress that has lived for at least two thousand years. It shades the church yard at Santa Maria del Tule. Below, a view of some the gnarled limbs and trunk of the tree.

The bigger tree is sacred to the Indians who live in this village, and no one may molest it, even to the extent of breaking off a twig. It is likely for this reason that no core-sample has been—or can be—taken to give accurate clue to its age. Some have boldly guessed it to exceed 6000 years, but Molisch, in his study of longevity in plants, is unwilling to concede much more than 2000 years to it. Under any circumstances this tree has silently witnessed virtually all of the development of civilization in its valley—the passage of the Zapotec builders of Monte Alban and Mitla's temples; the fifteenth century invasion of the Aztecs; the conquering armies of Cortéz, whose men took shelter under the branches of the giant in 1529 and there hung the king, Cuauhtemotzin; the passage of the explorer Maxmilian, who nailed to the tree his name and an inscription now almost hidden by bark. Soon it

will be an object well known to the army of tourists, who will pass near its morning shadow on their way southward to Guatemala.

The tree seems not to have been accurately measured since 1884, when its greatest diameter was forty feet, its circumference 172 feet, branch spread 140 feet, and height 130 feet. The shadow of the tree's crown, when the sun was in the zenith, would cover a four-hundred-foot circle. Its height is not impressive, when compared with others or its kind, such as the Arbol de Montezuma in Mexico City, but in this barren countryside it is a landmark discernible from the summit of Monte Alban, about fifteen miles away. The giant of Tule shows its swamp-loving character by the "knees" it sends up from its roots, but the churchyard is quite dry and dusty and the tree must tap water sources no longer apparent. Its home is a quiet little town, where soft-eyed and quiet-spoken little girls, with their *rebozas* wrapped turban-fashion about their heads, may offer you gardenias, where the castor oil bean grows brilliantly, to furnish oil for the saints, where households are separated, commonly, by fences of living organ cactus, neatly trimmed along their tops and so tight that a hen could not pass through one.

When we first approached the church of Santa Maria del Tule, the bells in the low-thatched shelter, to which they had been removed because of frequent earthquakes, tolled out. From the brightly-painted church filed a little procession of men playing a dirge in brass; four more men carrying a flower-decked black box on their shoulders; women and children carrying lighted tapers. They passed beneath the branches of their great ahuehuetl, the life span of which had already encompassed perhaps a hundred generations, and is a symbol of near-immortality.

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Learn an "Ine" or Two!

By GLENN YERK WILLIAMSON

A surprisingly large number of adjectives, all ending in "ine," are used by zoologists when reference is made to certain birds and mammals. For example, bovine signifies the cow; canine, the dog; equine, the horse; feline, the cat. But below are words less commonly seen. Can you pair them with their mates in the second column? Checking results, you will add to your fund of knowledge and increase your vocabulary. If you get ten right, you are good. If you hit fifteen, you are remarkable. And anything above that mark puts you in the near-genius class, provided you are a layman and not a zoologist. Answers are on page 552.

1. accipitrine	a. parrot	14. lumbricine	n. swan
2. anserine	b. squirrel	15. lupine	o. eagle
3. aquiline	c. sheep	16. mephitine	p. fox
4. cervine	d. hare	17. murine	q. porcupine
5. columbine	e. crow	18. ovine	r. pig
6. corvine	f. earthworm	19. pavonine	s. goose
7. cygnine	g. lizard	20. porcine	t. deer
8. formicine	h. mouse	21. psittacine	u. bull
9. hircine	i. pigeon (dove)	22. ranine	v. lion
10. hystricine	j. goat	23. sciurine	w. hawk
11. lacertine	k. wolf	24. taurine	x. bear
12. leonine	l. frog	25. ursine	y. skunk
13. leporine	m. peacock	26. vulpine	z. ant

(Perhaps because almost everyone else is doing it, we have not used quizzes in Nature Magazine. It may be that we are wrong and that many of our readers would like them. If so, we would appreciate a postcard to that effect. The quiz above seemed rather better than the average, and therefore a good one with which to break precedent.—EDITOR.)

U. S. FISH AND WILDLIFE SERVICE PHOTOGRAPH

The nine-banded armadillo is gradually extending its range in Texas and in parts of the Southeast, after having become increasingly rare. Scientists have carefully studied its habits and find it largely beneficial.

It's an Armadillo

By FRANK DUFRESNE

IT CAME, humpety-bump, out of the low thornbushes by the Texas roadside, like a jalopy with flat tires left front and right rear. Fenders flopping, it scurried by within a dozen feet. We could almost hear it creaking at the joints. It was one of the queerest little beasts one ever saw.

"Armadillo," we said as it put on the brakes, and, with its strongly-clawed forefeet, began digging furiously in the soft sand.

The dirt and dust flew out behind as though expelled from a rotary fan. In no time at all the armadillo had buried itself so that all we could see was the long, scaly tail lashing around like a snake. Then it came backing out, grunting and fretting, and so wrapped up in its own affairs it did not see us standing there. The claws gouged into a new spot; the thin, barbed tongue shot out to capture a beetle. Suddenly, it became aware of our presence, and, rearing up on its stubby, bowed legs, its pointed nose sniffed the air, the long, flat head turning and twisting until we felt the animal's breath against our legs. We stood still, wondering if it was going to roll itself into a ball like all good story-book armadillos. But this one had other ideas. It took a good look at us through its squinty little pig eyes, bounced into the air a couple of times, then tore out of there like one of Patton's tanks.

Most northerners do not realize it, but these underslung, armored creatures are by no means the rare animal they were a few years ago. In the past forty years they have been pouring across the Mexican border at a rate little less than astonishing. Southern Texas used to have the American monopoly on the armadillo, but now it is found in parts of New Mexico, Arkansas, Oklahoma, Louisiana, Mississippi and Florida. In some places the abundance has reached fifty or more armadillos to the square mile. It has come most of this way under its own power, even to swimming the Mississippi River, which is no small feat for such an animal. Tourists, carrying them around as pets, have also helped spread their numbers, and a few 'dillos escaping from a zoo near Cocoa, Florida, have formed colonies in that vicinity.

By all accounts the armadillo is here to stay, whether we like it or not—and there are some who do not like it. There are sportsmen who say it is a despoiler of birds' nests, particularly those of quails. Farmers complain that the animals tear down their corn; that they ruin their melons and tomatoes. Before this tropical invader got too strong a foothold

Three baby armadillos. One of the numerous peculiarities of this animal is the fact that there are usually four young and all of the same sex.

north of the boundary, the United States Fish Wildlife Service teamed up with the Texas game authorities to find out what manner of beast it was. Was it a bad, bad alien needing extermination, or did it have the makings of a good citizen?

Scientists long ago had placed it in the primitive Order of Edentates, in which are also included the anteaters and sloths. Edentate, meaning toothless, does not quite describe the armadillo because it has a few peg-shaped molars. Most of its many varieties are confined to Central and South America. Only one kind ranges north of the Mexican border—the nine-banded armadillo. It has a tough, shell-like carapace covering its shoulders, another over the hips. It gets its name from the nine telescoping bands connecting the two shells, which are merely thickened sections of hide and not parts of the bony structure. The armadillo weighs from ten to fifteen pounds. The mule-like ears have a texture like that of fine, pebbled, morocco leather, and the tail is covered with horny, overlapping rings. No one seems to know what the animal does with its tail except to sit down on it kangaroo fashion, but for souvenir makers the tail is a fine handle for the dried hides made into baskets. Another purpose is found when the natives roast this "poor man's pig" in its own shell—the tail makes a safe pot handle.

While its armor plate offers protection against thorny bush and cactus, there is little evidence that the nine-banded armadillo curls into a ball to ward off enemy attacks. Only when it has been badly injured, or completely worn out from struggling, does it appear to show any such tendency. Rather, it seeks safety in erratic dashes comparable to the flight of a cottontail rabbit. If you insist on your armadillo wrapping itself into a spheroid you will have to go down to Argentina or Bolivia, where an extremely thick-hided variety known as the three-banded armadillo will change itself from a galloping tank to a basketball like magic. You will find some more odd members of the family down that way, too, including one variety more than five feet long. Another kind, less than six inches in length, is shingled only along the top of the back; the rest is covered with a soft, woolly fur like a mole, and, like a mole, it spends most of its life underground. In South America they use the armadillo shells for guitars, and the long tails of the larger species do service as trumpets for signaling in the jungles. One small variety is so toothsome that the natives call it a "quail."

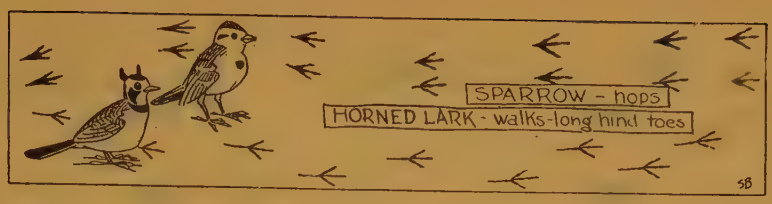
Armadillos pay little attention to other wild animals, but go around minding their own business. And a lot of queer business it is, too. They even start out in life differently from other animals because they are born normally as quadruplets, all of which are of one sex! The reason for this is that they are all developed from a single fertilized egg. Once in a while there might be two, three or five in a family, but in all cases they are either all males or all females. The nine-banded armadillos do their honeymooning in July, but the young do not arrive until the following March or April.

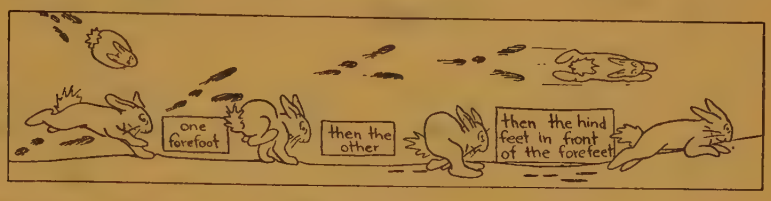
Armadillos are forever digging burrows, then abandoning them. The muscular development in the shoulders and front legs seems designed especially for such excavating. When one finds an armadillo burrow and starts to dig out the occupant, more often than not one will find it appropriated by rabbits, cotton rats, skunks, or opossums, even a burrowing owl.

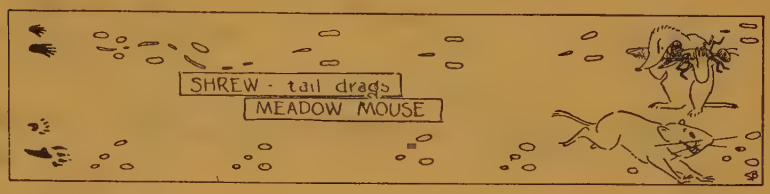
Many armadillos are killed by passing autoists, and it is largely their own fault. They do much of their prowling at night, for one thing, and, like all wild creatures, they are blinded by headlights. But that is only part of the story. When suddenly alarmed they have the bad habit of jumping straight up into the air. Even if the wheels miss them they are almost sure to have their heads cracked. The pungent odor they can release from specialized glands not only does them no good when an auto comes along, but dogs, wildcats, coyotes and other natural enemies pay little attention to it.

If one throws an armadillo into the water it sinks like a rock. If it is a smallish body of water the animal will often walk right along on bottom until it reaches shore. But if it is a sizable river or lake the armadillo has another scheme. It comes fighting to the surface paddling desperately to keep even its long nose above water. "It cannot (Continued on page 552)

This is the thirty-seventh in Nature Magazine's series of educational inserts







He Who Runs May Be Read

Notes on One Hundred and One Kinds of Animal Tracks

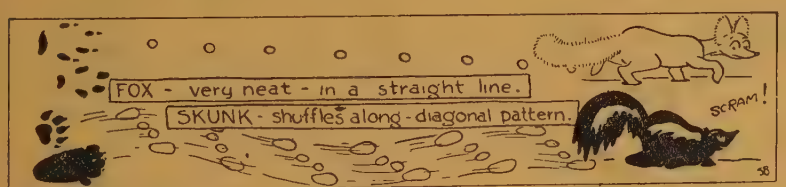
By **E. LAURENCE PALMER**

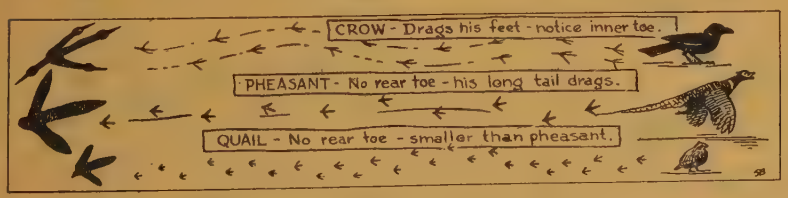
FOR more than twenty years I have had one hobby that has given me much pleasure. For twice that time, and more, I have been getting experiences that have enriched that hobby. I expect to continue it as long as I am free and able to roam the hills and valleys in summer or winter. I now have pictures, or casts, that I have taken of the tracks of all but a dozen of those birds, mammals and other creatures whose story is here presented. It is a hobby that can be shared by everyone and one whose popularity should increase with the greater opportunities for travel that our peacetime pursuits may offer.

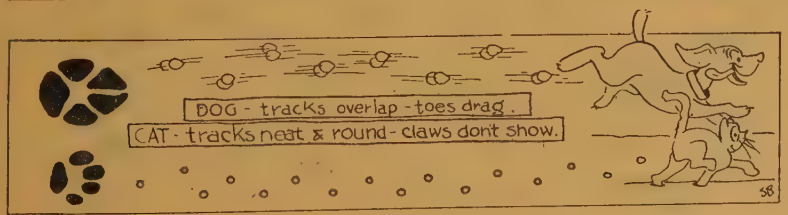
Field experience in the study of tracks is, of course, better than any book experience can be, and it is much more fun. While there are shown here pictures of some details of the tracks of different creatures, anyone with field experience will recognize that only rarely does one find two tracks exactly alike, and, more rarely, does a track show all the details it might, so varied are conditions afield.

A few hints on tracking will be welcomed by the novice. One does not need to be a Sherlock Holmes to recognize that there is a conspicuous difference between the tracks of mouse and man. But even men vary in size, and their tracks vary accordingly. However, size is one of the first things to notice in attempting to identify a track. To help, this insert includes charts showing the relative size of the front and hind feet of many mammals, some birds, and other creatures. The illustrations and data given here should be considered only as suggestive. They cannot fit accurately every situation one will find.

After studying a series of strange tracks one should be able to form some judgment of the size of the animal that made them. A group of two or four tracks may be taken to be a series that is likely to be repeated. If the animal is a quadruped, two of the tracks will be made by the hind feet and two by the forefeet. Often these give some suggestion as to the length and width of the animal. A rabbit, with a span between the outer margins of the hind legs of five inches, obviously makes a wider series of tracks than does a mouse with a span of nearer an inch. A walking cat commonly puts a hind foot in a track made by a forefoot, but a series of three or four such tracks should indicate the approximate length of the animal. It is not so easy to interpret length or width, of course, when an animal has been speeding, but even such a trail has some significance.

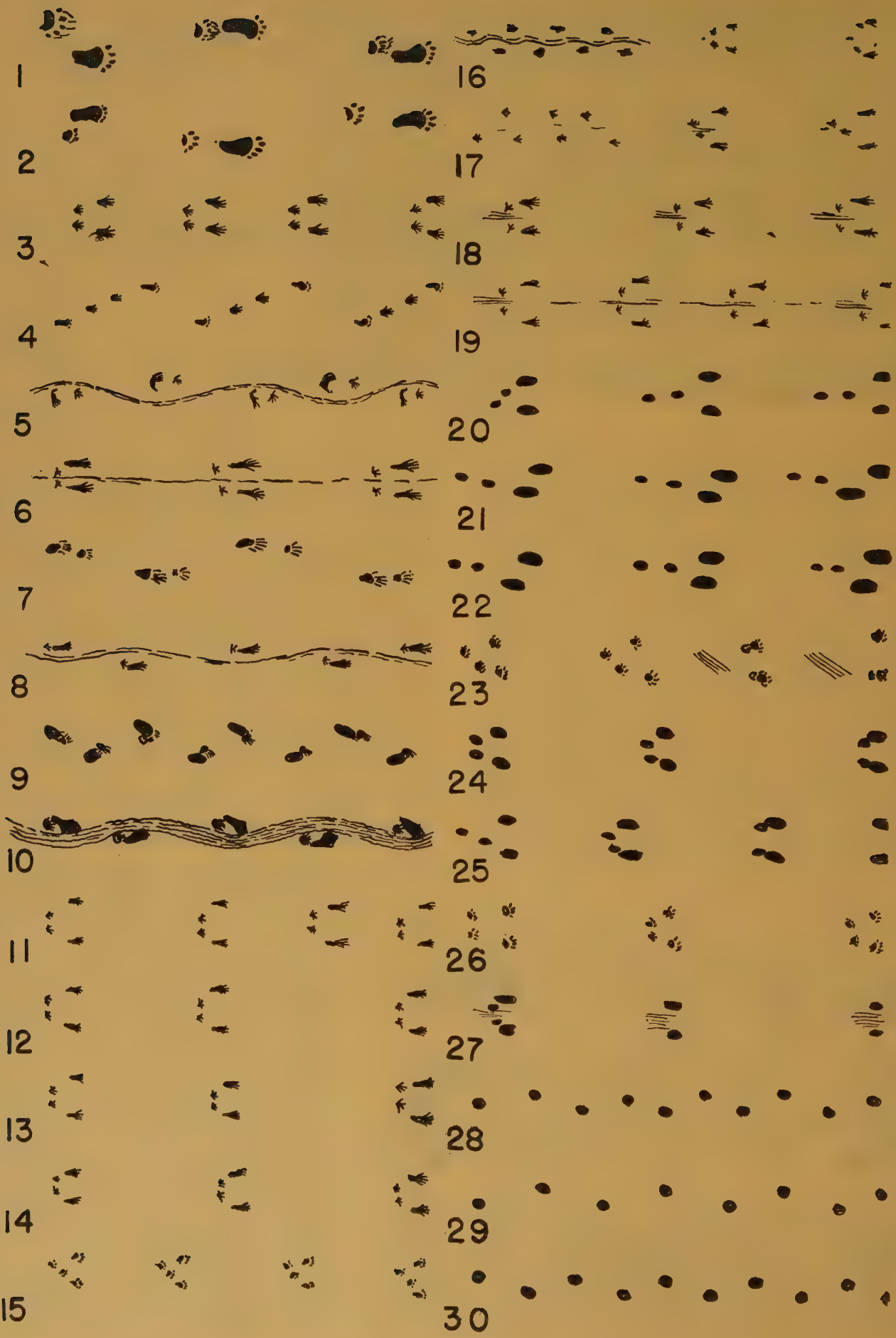






If one wishes to follow and, perhaps, find the animal that made the track, he must be able to interpret direction from what is seen. A famous psychologist friend of mine, trained in conventional signs, said that he always thought of a pheasant trail as marked by arrows indicating the direction the bird had taken.

But there are some things less subtle than arrows indicating directions in tracks. A cat track may appear to (Continued on page 536)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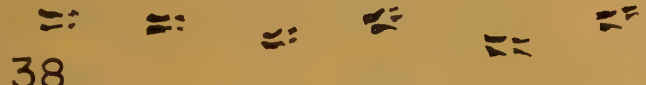
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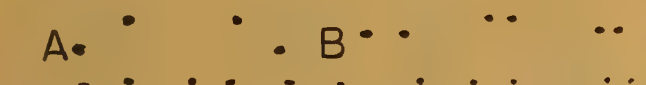

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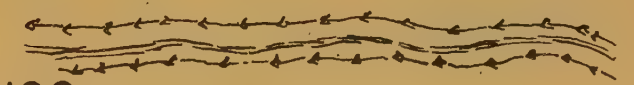
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Notes on Mammal Tracks

KEY: H.F. means hind foot; F.F. means front foot. Stride is distance from one foot track to next forward. Leap is distance from track of one foot in a series to next track of the same foot. The numbers in parentheses *after* each mammal, bird or reptile name refer to the number of the insert in this series in which that animal was given more detailed treatment. The numbers *preceding* each animal's name refer to the tracks shown on the opposite page, and, also, to the tracks shown on pages 530 and 531.

1. *Grizzly Bear.* F.F. to 6″ long, with 5 claws. H.F. to 12″ with 5 claws. Front feet toe inward.
2. *Black Bear* (17). F.F. 3″ by 4″, five-clawed. H.F. 4″ to 7″, five-clawed. Slow stride to one foot.
3. *Raccoon* (12). F.F. 2½″x3″, 5 thin fingers. H.F. 2½″x4″, 5 thin toes. Stride: 7″. Leap: to 20″.
4. *Common Skunk* (12). FF. 1½″x2″, 5-clawed. H.F. 1½″x2½″, 5 claws. Stride: 5″. Form diagonal line.
5. *Opossum* (12). F.F. 1¾″x1½″, 5 spread toes. H.F. 1¼″x2½″. Toes, 4 and 1. Spread: 6″. Tail drags.
6. *Norway Rat* (7). F.F. ½″x½″, 5-toed. H.F. 1½″x½″, 5-toed. Spread: 4″. Tail drags.
7. *Woodchuck* (12). F.F. 1½″x1¼″, 4-toed. H.F. 1¾″x1¼″. 5-toed. Spread: 4 inch. Leap: short.
8. *Muskrat* (12). F.F. 1½″x1¼″, 4-toed. H.F. 3½″x1½″, 5-toed. Spread: 3″. Stride: 8″. Tail.
9. *Porcupine.* F.F. 2″x3½″, 4-toed, long claws. H.F. 4½″x2″, 5-toed. Stride: 1′. Toes in plainly.
10. *Beaver* (12). F.F. 2½″x3½″, 5-toed. H.F. 5½″x7″. 5 webbed toes. Stride: 16″. Toes in. Tail drags.
11. *Fox Squirrel.* F.F. ¾″x1¾″, 5-toed, paired. H.F. 1″x2″, 5-toed, paired. Spread: 6″. Leap: to over 5′.
12. *Gray Squirrel.* F.F. 1″x1½″, 5-toed, paired. H.F. 1¼″x2½″, 5-toed, paired. Spread: 3¾″. Leaps to 5′.
13. *Red Squirrel* (12). F.F. ½″x¾″, 5-toed, paired. H.F. 1″x1¾″, 5-toed, paired. Spread: to 3″. Leap: to 5′.
14. *Flying Squirrel.* F.F. ½″x½″, 5-toed, paired. H.F. ¾″x1¼″, 5-toed, paired. Spread: to 2″.
15. *Chipmunk.* F.F. ½″x⅜″, 5-toed, not paired. H.F. ¾″x1¼″, 5-toed, paired. Spread: to 2 inches.
16. *Short-tailed Shrew, Blarina.* F.F. ¼″x¼″, 4-toed. H.F. ½″x½″, 5-toed. Alternates in walking. Tail.
17. *Meadow Mouse.* F.F. ½″x½″, alternates. H.F. ½″x¾″, 5-toed, paired. Spread: 1″. Tail may drag.
18. *White-foot Deermouse.* F.F. ¼″x¼″, 5-toed, paired. H.F. ¼″x½″, 5-toed, paired. Spread: to 1¼″. Tail.
19. *House Mouse.* F.F. ¼″x¼″, paired or not. H.F. ½″x¾″, 5-toed, paired. Spread: 1½″. Tail mark long.
20. *Cottontail.* F.F. 1″x1″, paired or not. H.F. 1¾″x3½″, paired. Spread: to 5″. Leap: to 7′.
21. *Jack Rabbit.* F.F. 1½″x1½″, not paired. H.F. 2″x3½″, not paired. Leaves a tail mark at times.
22. *Varying Hare.* F.F. 3″x3″, not usually paired. H.F. 3½″x6½″, paired or not. Slow hop: to 2′.
23. *Otter* (12). F.F. 2½″x3″, 5 padded toes. H.F. 3″x3″, hair padded, paired. Leaves slanting tail mark.
24. *Fisher* (12). F.F 3¼″x2½″, 5-toed, 1 aside. H.F. 3″x2½″, 5-toed, paired. Front and hind tracks overlap.
25. *Marten* (12). F.F. ¾″x1½″, 5-toed, short. H.F. 1¼″x2″, 5-toed, short. Spread: 4″. Leap: to 3′.
26. *Mink* (12). F.F. 1½″x1½″, paired. H.F. 1½″x1½″, 4-toed, paired. Spread: 5″. Leap: 2′. May slide.
27. *Weasel* (12). F.F. 1″x1″, 4-toed, paired. H.F. ½″x1½″, 4 padded toes. Tracks overlap. Tail drags.
28. *House Cat* (7). F.F. 1¼″x1″, 4-toed, alternates. H.F. 1″x1″, 4-toed, alternate. Stride: 6″. Feet track.
29. *Bobcat* (12). F.F. 1¼″x2″, 4-toed, alternate. H.F. 1¼″x1½″, 4-toed. Stride: to 14″. FF. & H.F. track.
30. *Canada Lynx.* F.F. 3″x3″, 4-toed, alternates. H.F. 3″x3″, 4-toed, rounded. Stride: to 18″.
31. *Cougar, Puma, Mt. Lion* (17). FF. 4″x4″, 4-toed, alternates. H.F. 4″x4″, 4-toed, alternates. Stride: 18″.
32. *Timber Wolf.* F.F. 4″x5½″, 4-clawed. H.F. 4″x5½″, 4-clawed. Tracks may overlap, alternate.
33. *Coyote, Prairie Wolf* (12). F.F. 3″x3½″, 4-clawed. H.F. 3″x3¾″, 4-clawed, alternates. More circular than wolf track.
34. *Dog (Fox hound)* (7). F.F. 2″x2½″, 4-clawed. H.F. 2½″x2¾″, 4-clawed, alternates. Irregularly arranged.
35. *Red Fox* (12). F.F. 1¼″x2″, 4-clawed. H.F. 1¼″x2½″, 4-clawed. Stride: 8″ to 18″, straight line.
36. *Gray Fox* (12). F.F. 1½″x2″, 4-clawed. H.F. 1¼″x1¾″, 4-clawed, alternates. Stride: 6″ to 16″.
37. *Sheep* (7). F.F. 3″x3″, 2-parted. H.F. 3″x3″, 2-parted, blunt ahead. Larger and broader than next.
38. *Mountain Sheep.* F.F. 2¾″x2¾″, 2-parted. H.F. 2¾″x2¾″, 2-parted. Points seem to curve inward.
39. *Mule Deer.* F.F. 2½″x3″, 2-parted. H.F. 2¼″x2¾″, 2-parted, pointed. Points more separate than next.
40. *Virginia Deer* (17). Buck may drag more than doe. H.F. & F.F. 2″-2½″x3¾″, 2-parted. Line between hooves straight.
41. *Antelope* (13). F.F. 2″x3″, 2-parted slender. H.F. 2″x3″, 2-parted, slender. Front and hind may track.
42. *Wapiti, Elk.* F.F. 3″x4¼″, H.F. 3¼″x4″, 2-parted. Bull toes out. Cow more so.
43. *Moose.* F.F. 5″x7″, 2-parted. H.F. 5″x7″, 2-parted, sharp point. Points curve inward to almost meet.
44. *Horse* (7). (a) trot; (b) pace. H.F. & F.F. almost round, 3½″x3½″. (c) canter; (d) gallop patterns.
45. *Cow* (7). F.F. Much like hind feet. H.F. 3½″x4″, 2-parted, pointed. Front and hind feet rarely track.
46. *Pig* (7). F.F. much like hind foot. H.F. 3″x3″, 2-parted with 4 often. Secondary toes commonly show.
47. *Peccary.* F.F. much like hind feet. H.F. 2½″x2¾″, 2-parted, curved. Round base and pointed tips.
48. *Mountain Goat.* F.F. much like hind feet. H.F. 2½″x2¾″, 2-parted, tips open. Highly variable.
49. *Goat* (7). F.F. much like hind feet. H.F. 3″x3″, 2-parted, points in. Outer margins heaviest.

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Notes on Bird and Reptile Tracks

50. *Swan.* Width: to 3″, 3 toes show. Length: to 4½″. Three toes webbed. Stride: relatively short.
51. *Goose* (9). Width: to 3″, 3 toes show. Length: to 4″. Three toes webbed. Stride: short. Hind toe.
52. *Herring Gull* (40). Width: to 3″, 3 toes show. Length: 3½″. Toes webbed. Stride: about 3½″.
53. *Mallard* (9). Width: to 2¾″, 3 toes show. Length: to 3½″. Toes webbed. Stride: about length of foot.
54. *Common Tern* (40). Width: to 1″. Length: to 1″. Three toes webbed. Stride: short. Impression shallow.
55. *Avocet* (40). Width: to 2″. Hind toe raised. Length: to 2″. Toes webbed. Outer toe more widely spread.
56. *Stilt* (40). Width: to 2″. Outer web less. Length: to 2″. Toes webbed. Outer toe freer and more spread.
57. *Godwit* (40). Width: to 3″. Outer web less. Length: to 2¾″. Toes slender, half-webbed. Hind toe shows.
58. *Gallinule* (9). Width: to 3″. Toes all slender. Length: to 4″. Webs not evident. Hind toe equals middle.
59. *Coot* (9). Width: to 3½″. Hind toe short. Length: to 4″. All toes with webs, with scalloped margins.
60. *Willet* (40). Width: to 2¼″. Outer toe long. Length: to 2¼″. Basal webs may show. Hind toe only as dot.
61. *Curlew* (40). Width: to 2″. Length: to 2″. Hind toe may show. Outer web larger than inner.
62. *Greater Yellowlegs* (9). Width: to 2″. Length: to 2″. Hind toe may show. Basal web middle to outer toes.
63. *Lesser Yellowlegs* (9). Width: to 1″. Length: to 1¼″. Female larger. Basal web middle to outer toes.
64. *Wilson's Snipe* (9). Width: to 1″. Toes slender. Length: to 1½″. Hind toe may show. Webs lacking.
65. *Woodcock* (9). Width: to 1¼″. Toes slender. Length: to 1½″. Hind toe shows. Webs lacking.
66. *Sora Rail* (9). Width: to 1¼″. Toes slender. Length: to 1½″. Long hind toe. Otherwise like woodcock.
67. *Least Sandpiper* (40). Width: to over 1″. Length: to ⅝″. Female the larger. No web obvious.
68. *Piping Plover* (40). Width: to over 1″. Length: to ¾″. Side toes unequal. Middle-outer toe-web small.
69. *Sanderling* (40). Web as a toe border. Length: to ⅞″. Three toes only. Smaller than next species.
70. *Semipalmated Sandpiper* (40). Width: about equals length. Length: to 1″. Four toes. Web shows.
71. *Solitary Sandpiper* (40). Middle-outer toe web moderate. Length: to 1″; width about same. Middle-inner web rudimentary.
72. *Spotted Sandpiper* (40). Outer to middle toe webbed. Length and width to 1″. Web to 1st toe joints.
73. *Wilson's Phalarope* (40). Web may show or not. Length: to 1½″; width about same. Front toes web margined.
74. *Golden Plover* (40). Basal webs between front toes. Length: to 1½″; width the same. Web may not show.
75. *Killdeer Plover* (40). Toes not webbed at base. Length: to 1½″; width the same. Hind toe need not show.
76. *Bobwhite Quail* (9). Side toes may spread widely. Length: to 1½″; width greater. Outer toe longer.
77. *Ruffed Grouse* (9). Front toes widened in winter. Length: to 1¾″; width greater. Front toes normal in summer.
78. *Ring-necked Pheasant* (9). Middle toe longest. Length: to 3″; width about same. Inner toe shorter.
79. *Domestic Hen.* Toe nails usually marked. Length: to 4″; width about same. Toes rather coarse, unwebbed.
80. *Turkey* (9). Like large chicken track. Length: to 5″; width about same. Back toe may show in deep mud.
81. *Great Blue Heron* (14). Hind toe slightly off center. Length: to 8″, all 4 toes show. Web suggestion base of foretoes.
82. *American Bittern* (14). All toes slender. Length: to 5″; all 4 toes show. Hind toe conspicuous.
83. *Night Heron* (14). Like small bittern track. Length: to 4″; all 4 toes show. Toes in front well spread.
84. *Green Heron* (14). Smaller of heron tracks. Length: to about 3″; 4 toes show. Fore toes, slender.
85. *Domestic Pigeon.* Four toes show each clawed. Length: to 2½″; width, to 1½″. Side toes even.
86. *Sparrow* (32). Side toes commonly shorter. Length: varies but to about 1″. Tracks paired by hopping.
87. *Horned Lark* (32). Hind toe unusually long. Length: to 1½″ showing 4 toes. Tracks alternate by walking.
88. *Robin.* Toes drag rather commonly. Length: to 2¼″, with 4 toes. Paired or alternate commonly.
89. *Starling* (32). Toes may drag. Length: to 2½″, with 4 toes. Most commonly alternate.
90. *Crow* (32). Inner-middle toes closest. Length: to 3½″, with 4 toes. Paired or alternate; toes drag.
91. *Diamond-back Rattlesnake* (4). Rather regular wave series. Broad-narrow areas. Broad are pushes.
92. *Side-winder Rattlesnake.* Snakes throw selves in series of long Ss. Clean throws show no connections.
93. *Hog-nosed Snake* (4). Typical serpentine track. Not the sidewinder type. Pushed areas emphasized.
94. *Banded Burrowing Snake.* Median line position (note). Inactive type. Rather uniform series.
95. *Sonora Snake* (1 type). Blank space indicates vigor. Undulating type like 93. More active than 93 as shown.
96. *Sonora Snake* (2nd type). Not so complete as 92. Sidewinding type like 92. Ends indicate dragging.
97. *Leaf-nosed Snake.* Broad, deep areas of stress. Vigorous somewhat rotary movement. Some areas faint.
98. *Sand Lizard* (4). Short legs make short stride. Tail may drag or not. No tail mark when speeding.
99. *Feather-footed Sand Lizard.* Tail of varying emphasis. Size of front and hind feet vary. In speed may not show front feet.
100. *Snapping Turtle* in mud (4). Short feet drag and regular. Constant tail drag undulating. Stride short.
101. *Dinosaur* (fossil). Note resemblance to birds. Sketch indicates one of many types. Size varies greatly.

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(Continued from page 529) be merely a series of round holes in more or less of a straight line. No toe marks show. How can you figure from that which way the cat was going? Just look at your own tracks in the snow. Do you slide into a track, or do you slide out of it? You, like a cat, slide into a track. This means that if you look at a round hole made by a cat track you will see that the chances are good that one profile is more nearly vertical than the other. The chances are also good that the more vertical profile was on the side towards which the animal was moving. This same generalization may be applied safely to other animals. It is particularly useful in interpreting the tracks of foxes, dogs and their kin. There may be times when, in old tracks, the rule does not hold because sun shining into a track hole may melt out the opposite side and thus change its profile.

One of the more popular ways of preserving records of tracks is to make casts of them. There are a few tricks to making good casts that may be worth remembering. While it is possible to make truly professional duplications by using expensive compounds of rubber, of collodion, of gum arabic and other gums, the rank amateur like myself is likely to deal with more prosaic substances. I have satisfactory casts made of mud, of plaster of paris, of wax or paraffin, and of type metal. It is rare that one cannot find one of these materials with which to work.

Mud casts are the simplest and least durable, but they will take the place of others when, in an emergency, you find a track so rare or unusual that you just must have it. If the track is in mud or sand take some dry leaves and crumble them to a powder in your hands. From a height drop these into the track until you have a thin film of organic material covering the track. If this layer is not evenly distributed the surplus may be blown free easily. Now mix some clay soil with water until you have a mud-pie mixture. Pour this into the track *from the side,* and, if you have time, let it dry or leave it until a later time when you return for it.

Wax or paraffin casts are emergency casts also. The commonest source of material is a candle, although, in cold weather, a poor substitute may be found in bacon grease. Casts are made with this material merely by melting the medium over the track and letting the molten material flow into the track. If the cast is of any size it should be reinforced with sticks such as matches or twigs. These may be laid criss-cross to give maximum strength, and the sticks should be covered with more wax or other materials used. Casts of these materials must be kept cold to retain any detail worth preserving.

Plaster of paris casts are the commonest of all casts. For years I never went on a hike without a baking powder can of plaster and a pop-bottle of water. I have two casts made high in the Rockies with such a supply that I carried under my year-old son in a pack basket.

Before plaster sets it develops considerable heat, which will ruin a good track taken in snow. Plaster should be mixed to the consistency of thick pancake batter so that it can just flow easily. This is best done by using an amount of water nearly equal to the amount of plaster wished, and adding plaster to the water, not water to the plaster. The mixture should be stirred until the right consistency is reached, and only enough plaster for immediate use should be mixed at a time. If your plaster has a tendency to harden too quickly for your convenience, add a little vinegar to slow it up. If it hardens too slowly, a little salt will hasten it. Once your plaster has set you cannot use it again by adding more water. A collar of paper, earth or sheet metal will make it possible for you to make a thicker cast with less plaster. Dental plaster hardens quickly and well.

Making plaster casts from tracks in mud, sand or loam is relatively simple. To do this merely place a collar about the track needed for preservation, pour the plaster batter in from one side to avoid disturbing detail by the weight of the falling plaster. Then wait until the plaster has set and remove it for safe-keeping.

To make plaster casts from tracks in fine snow on a cold day, it is well to carry an atomizer with you. Spray the track with water until a fine but firm crust has been formed. Then, dust some dry plaster on the crust and mix your plaster, using slush instead of clear water. Let the plaster flow over the snow track from one side to avoid any disturbance from the falling weight.

If one wishes to make a positive of plaster this may be done by first putting a collar around the negative; then brushing the surface of the negative with vaseline. Pour your plaster over the vaseline, and, when it has hardened, separate the two and you have a positive duplication of the track you first found.

The person who merely makes a collection of track casts, drawings or photographs is missing the greatest opportunity that goes with tracking. The reading of tracks is thoroughly worthwhile. An animal's track indicates not only its size and character, but its mood at the moment as well. Watch a deermouse in the snow and you will see where it obviously was having fun hopping about, using its tail to help it swing sharply around corners. You will find where it merely hops a few inches to get a fresher bite of some meal. Again you may find it setting out crosslots to get somewhere as quickly as possible. Set yourself the task of reading these moods and you have learned a new vocabulary of Nature. If you happen to be a paleontologist it may enable you to interpret the structure, food habits and very existence of some animal that no man ever saw. You will learn to recognize how a huge snapping turtle, buoyed by water, may make delicate toenail tracks in mud at the bottom of a pond, or a deeply rutted trail in the wet mud at the pond edge. What you learn of the snapping turtle and the rabbit may help you understand the trail of a dinosaur. The Grand Canyon of the Colorado has exposed the trails of animals long since extinct. The strata in which these tracks were found tell us something of the time when they were made, but a proper interpretation of the tracks makes conditions of that time more significant. I know a fossil bed in Pennsylvania where something like a horseshoe crab left hundreds of its trails in very ancient muds. The interpretation of those trails made some paleontologist friends of mine more than usually excited for better than a year. I hope that you will want to join the ranks of those who know that those who run may be read.

Impending Tragedy in the Adirondacks

BECAUSE it is typical of many similar issues that will face conservationists in postwar America—issues of exploitation as against other, and, to us, greater, values—we are happy to give over our editorial page this month to the following statement signed by Paul Schaefer of Schenectady and Edmund H. Richard of Fort Plain, both New York conservationists:

"The South Branch of the Moose River rises on Little Moose Mountain just west of Cedar River flow in the central Adirondacks. It flows westerly towards the Fulton Chain Lakes country, bisecting for about thirty miles the most extensive primitive area in these mountains.

"Here is a land roughly forty miles long by twenty-five miles wide, dotted with lakes and ponds and threaded with rivers and streams. It is heavily forested and without clearings, except for the unique natural Moose River Plains which are situated near the heart of this region.

"It is a land of vast distances and solitude and yet, despite its remoteness, is surprisingly accessible. Good foot and saddle trails reach the interior, while amphibian planes make even the wildest pond accessible from the Fulton Chain Lakes in a matter of minutes.

"The mountains are not tall, but present rounding contours which dip gracefully into the myriad lakes and ponds of every description. Spruce and balsam dominate the long reaches of valley, with pine and hardwoods covering the ridges and hills.

"It is this region, along the South Branch of the Moose River, which would be inundated by construction of the proposed Higley Mountain and Panther Mountain reservoirs.

"An official report of the New York State Flood Control Commission reads in part:

" 'Pending before Congress is a war department report on a study of the Black and Moose Rivers. It recommends construction of a multi-purpose reservoir at Panther Mountain on the Moose River. This reservoir, estimated to cost $3,800,000, would be located about eight miles east of McKeever in Herkimer County.

" 'Stream flow regulation, with a view towards development of hydro-electric power, is the primary purpose of the proposed reservoir. Flood control is a secondary consideration. Because of the nature of the proposed project, its prosecution and the requisite of local cooperation are a matter of direct concern, not to the Flood Control Commission, but to the Black River Regulating District.

" 'As recommended, Panther Mountain Reservoir will have a storage capacity of 278,000 acre feet, of which only 16 per cent will be reserved solely for flood control utilization. The Black River Regulating District has indicated willingness to participate in the project.'

"Higley Mountain Reservoir would be located about six miles upstream, or about 14 miles east of McKeever. Its purpose is primarily stream flow regulation.

"This latter reservoir would be built largely on Forest Preserve land and would put the famous Moose River Plains under more than forty feet of water. Helldiver Pond, Icehouse Pond, Beaver Lake and the Lost Ponds would be inundated, as would the best sections of the Red River, the Sumner, the Otter, the Indian and other streams.

"The Moose River Plains are known to be the largest winter yarding grounds for deer in the Adirondacks. It is estimated that more than 1,000 deer seek the food and shelter of this region in the winter. For many years the Conservation Department has conducted surveys of deer in this region. The outline of the proposed reservoirs' water level is substantially the winter shelter area of these great deer herds.

"Winter shelter and winter food are the limiting features as regards the number of deer in the Adirondacks. It follows, therefore, that this largest of all deer herds in the Adirondacks will in all probability be exterminated, and the region for miles around will lose the source of its extraordinary deer population.

"The character of the region, plus the distances involved in traversing it, make this region a sanctuary and source of many other animals, including the bear, the otter, the fisher and other less common animals. Birdlife is abundant, with the ruffed grouse having ideal conditions of habitat.

"Fishermen come hundreds of miles to enjoy the superb trout waters of the region. Not only will the rivers and ponds lose their trout by creation of the reservoirs, but innumerable tributary streams will be destroyed for this fish. Further, it is doubtful if pike and similar fish could be kept out of the reservoirs and this would finish the trout in this area.

"The Moose River region is the finest remnant of natural woodland left in eastern America. The region is large enough, and it is remote enough and primitive enough to be one of the outstanding scenic attractions in all America. It is a land that attracts naturalist and hiker, as well as hunter and fisherman. It has values that are intangible and beyond adequate description. It is an attraction that beckons tourists from far places, that they might see and feel and understand the primeval beauty of the Adirondacks.

"The construction of Panther Mountain and Higley Mountain reservoirs is naturally supposed to be of economic value to the state or region, directly or indirectly. But what are the economic losses caused by such reservoirs?

"Of great importance to the region and the state is the abundance of fish and game. This factor alone is of great significance in the (Continued on page 549)

Something to Remember Us By

By LEONA TRAIN RIENOW

Photographs by Aubin

ANY enterprising community may plant itself a beautiful park for the future; some lucky ones even have bodies of water around which to build their parks. But to only one section in all the Northwest has been vouchsafed the rare privilege of acquiring a fully-grown God-made park, with trees ranging up to three hundred years in age, standing between the sandy shores of two sparkling spring-fed lakes!

And now, after ten months of assorted panic, hope, despair, petitions, telegrams, meetings, hearings, minor victories and, finally, almost positive failure, this jewel is ours—and posterity's. It has been snatched from the lumberman's axe to become a state and community park—a "living memorial" dedicated to the men who fought this war for us, and a monument to our own almost superhuman efforts in the cause of natural beauty.

McCarthy Beach Forest, a privately-owned strip of virgin white and red pine, has long been a landmark of the western Mesaba Iron Range. The citizens of Hibbing and Chisholm learned to swim off its gently-sloping shores, for the pioneer, "Old Man McCarthy," was a tolerant, recluse owner who seldom put in an appearance, and never scolded at campfires or tenting parties. Some deep personal satisfaction, some strange quirk of pride prevented this old gentleman from lifting his hand from a square yard of the choice 147 acres that he himself had pioneered under the Homestead Law. This was *his* land; these were *his* trees. Others might enjoy, but never own!

Then the Old Man died. A daughter sold it for a piffling sum to a city lumberman, to be immediately cut over, and the two communities woke out of their complacent dream to a harsh and terrifying reality.

That was September, 1944. What happened then shows what this friendly forest, this last gallant stand of the "tall timber", had come to mean to the people of the Range. Never had helpless, dumb trees so many fighting defenders.

Over night shocked protests broke out into a loud clamor. Every organization, from the Legion and VFW to the garden and sewing clubs, voted resolutions, denouncing the destruction. Spontaneous petitions sprang up in the banks, in the Red Cross; were carried from gathering to gathering by changing hands. The aid of the Governor, the Conservation Commissioner, the County Board and the Legislature was solicited. Everyone was frantic. At length, the lumberman himself was moved to make an offer of sale — at a fancy profit of approximately 233 per cent!

But by now nothing mattered except saving the beloved trees. Well we realized that this original forest was the last remnant of accessible virgin pine in all Minnesota that was not already protected by a park. But, to us who had been brought up in it,

The McCarthy Beach Forest road leads through beautiful timber in which virgin white and red pine predominate. It has been a landmark of the western Mesaba Iron Range for fifty years.

McCarthy Beach Forest is a relatively small tract of virgin timber lying between the cities of Hibbing and Chisholm in Minnesota. Its preservation and dedication as a living memorial to those who gave their lives in World War II mean comparatively little to millions of Americans who will never see it. But the manner in which it was saved; the stirring demonstration of the power of democracy at work that that saving provided, mean something to all of us. Read this story with such thought in mind and see if it does not thrill.

it was more than a relic or an historical landmark. It was an Entity.

Women stopped in the street to discuss the possible cutting in hushed tones, or looked up from their bandage folding with eyes widened in concern at its mention. Men orated about it in their clubs of an evening. The papers carried headlines and editorials. Duluth papers copied. And the people, unsolicited and freely, came forward with a thousand dollars to stay off the lumber company until April, 1945, before which date they hoped, by some fantastic means, to be able to raise the $50,000 needed to acquire title to Old Man McCarthy's once precious acreage.

"My kid swims up there in the summer. We can't afford a summer cabin of our own. Here's five dollars." "My boy's lost over Germany, but maybe he'll come home some day, and if he does, I want him to find that beach just like he left it. Here's twenty-five." "The Legion and VFW think it would make a first rate 'living memorial' to our dead soldiers, and a fine recreation spot for the ones who come home. We'll pitch in big."

That was when the State Conservation Commissioner, the local and state foresters and the State Park Director began to offer help and counsel. Their interest was never failing.

Finally, in committee meetings, City Council meetings, Junior and Senior Chamber meetings, and over afternoon tea cups, the plan took form. The County Land Commissioner here came to our aid. We would introduce bills in the State Legislature asking the State to make this lovely forest a State park—a memorial park. The State might pay half of the purchase cost; the two communities most interested, the other half. That seemed fair enough.

But the local "improvement" funds were tied up by law from such use. How could we obtain the use of these funds in our local councils? Our lawyers informed us this would require an "enabling act" to be passed by the Legislature, in addition to the passage of a bill giving us a possible State appropriation. Our ablest lawyers rushed into conference, worked long hours over the details, then sent them to the State Conservation Commissioner for approval.

"It can't be done!" cried the skeptics. "There's a law against having a park seventeen miles outside the city limits." "Those southern Minnesota farmers won't vote us any appropriation. They hate the Range. They think we're all rich, and they're jealous of us." "You can't get the State conservation officials to appear at your hearings. The

Hikers follow this trail through the forest that has now been preserved for posterity as a memorial to men of the region who gave their lives in World War II, many of whom knew the area as boys.

State Scenic Park's too near. They don't think we need a park here. Besides, they can't raise any money for conservation now." "We're 240 miles from the capitol. How can we keep our men down there to work for the bill? We're out of luck, that's all."

But, through it all, a little, determined, reckless group persisted; a nucleus of fervent, desperate determination; of faith, if you will, supported by our two public-spirited newspaper editors.

There were difficulties aplenty, not the least of which were the facts that every action required consultation between the interested groups in both Hibbing and Chisholm, and that there was no one authorized chairman of the whole undertaking. It took until March 14 even to get the bills introduced in the Senate and House—and the Legislature was scheduled to close April first! "Too late! Too late!" droned the cynics, shaking their heads. And even the die-hards were scared stiff.

It was then that the people really got busy. Telegrams flew about the State. The Masons, Moose, sportsmen's clubs, the Legion and Veterans of Foreign Wars, their Auxiliaries, the City Councils, the Kiwanis, Isaak Waltons and "Sturgeon Lake Improvement Club" all put forth committees for active work. Lawyers, bankers, the school superintendent, businessmen and housewives put in long distance calls to their friends in the Twin Cities. Our state legislators kept us constantly informed. And the bill began to move slowly through the Public Domain Committees.

Without one chairman over the actions of both towns, the whole undertaking was haphazard, tentative, disorganized. But there was an impelling quality that fused all this unconcerted action into a great, irresistible ball that started rolling relentlessly toward the State Capitol, smothering all opposition in its wake.

It was pure democracy at work. It was the single, most impressive argument for the virtues of a government such as ours that I have ever witnessed. And if it proved anything at all, it proved that in America the will of the people, if it is strong enough, can overcome any opposition in its path and attain its aims.

Yet the worst impediments were ahead. The bills reached the two finance committees and stuck there. The Legislature was dragging over into April, but was to adjourn on April 18 without fail. On April 10 the two bills were still stuck, competing with scores of others for attention, and with pretty slim chance of getting it. To southern state legislators, McCarthy's Beach was just another H.R. 1012, or File 956: "An Act for Appropriation of State Funds for the Acquisition . . . etc." And there were so many of those!

The Oak

By ALBERT RALPH KORN

No monument that man has planned
Can hold such beauty as a tree;
No marble hewn by master hand
Is noble as an oak can be.

Now even the die-hards began to find themselves expressing grave doubts. The cynics were having a heyday. Oh, how tough the chairman of the House Appropriations Committee and the director of the Senate Finance Committee were! Their hearts were flint and their red pencils ever sharpened and active! No appeal, no sentiment could touch their case-hardened ears. And now, only six days to go. . . .

But the die-hards were going down in a blaze of fireworks, if they had to go down. And now friends of McCarthy's Beach in other parts of the State rallied to its aid. The American Legion sat down of a Sunday with four stenographers and sent special delivery letters to sixty-two legislators. Prominent businessmen from both Hibbing and Chisholm, including the ever-active Junior and Senior Chamber of Commerce committees, sped to St. Paul to try to pull the chestnuts out of the fire. Letters from overseas servicemen began to seep in pleading for the park.

And then, belying all their reputed hardness of heart and forbidding reputations, the chairmen of the two finance committees, once they were made cognizant of the emergency facing the forest, and of its unusual beauty and value to the State as a whole, recommended the bills out of committee for passage! For this deed may they be blessed!

But our cheers were short-lived. There were now only two more days of the session to go, and perhaps 600 or more bills for the Legislature to consider. By an unfortunate lack of judgment, our Senator had accepted the legislative post just before going into the army on a commission, leaving his district completely unrepresented in the Senate. Supposing our bills were left to die now, after all this work?

Our Representative in the House would make the McCarthy bill his "special"—thus almost insuring its being voted on. But to save the Senate bill certain of our citizens had to make another trip to St. Paul, invade the Senate chambers, bodily pluck our File out of the mountain of legislation and literally hammer and tong it through to a vote. How much we owe to our State President of the Isaak Walton League cannot be estimated, nor to three or four other officials of the State and County who made our fight theirs.

But most of all the passage of the McCarthy Beach bills through the Legislature is a victory for the man in the street, and the woman in the kitchen, who went to bat one hundred per cent to bring this park to a reality. It is the gift of our generation to posterity, to our returning servicemen, and a living memorial to their unforgotten dead. It is something to remember us by in the years when our generation is no more.

Big-game specialists credit the game-eating lion with ability to spring into action and kill its prey, such as buffalo, zebra or eland, in less than half a second. However, the cheetah seems to be entitled to some speed record since it is believed capable of attaining a speed of forty-five miles an hour from a standing start in two seconds.

The Split-Second in Nature

By FRANK W. LANE

Life and death in Nature are often divided only by a small fraction of a second. Because of this the lightning-like reaction to emergency, the invisibly-quick blow of predator, and the no less speedy evasive action of its prey, are vital factors in the lives of animals.

Some workers at the London Zoo once wanted to obtain some motion pictures of a toad swallowing a worm. To do so, a high-speed camera was used, with the mechanism adjusted to take 300 pictures a second. When all was set, and the camera whirring, a worm was placed in front of the toad. The next thing the watchers knew was that the worm had vanished.

The whole action—the tongue flying out, gathering the worm and returning to the mouth—was said to take place in a small fraction of a second. The great student of toad life, Jean Rostand, says: "The speed of lingual projection is considerable. The double journey, there and back, takes less than a fifteenth of a second."

The American sparrow-hawk is an avian speedster. One was seen to pick a lizard from a tree trunk while in rapid flight and without a pause.

The strike of some poisonous snakes is also very rapid. In fact I have seen the strike of a rattlesnake described as "the fastest thing in Nature." That may well be an exaggeration. After all, in the Southwest road-runners not only evade the rattler's strike but get in a deadly peck of their own. But a snake can certainly pack action into the unforgiving split-second. The late Raymond Ditmars, famed herpetologist of the New York Zoological Society, once said: "Stroke, bite, pressure on the poison glands, injection of the venom and return of the head to the snake's defensive position normally take less than half a

second." Considering the movements and actions involved, this is certainly rapid action.

The stroke of a fighting-cock is another extremely speedy movement. It is claimed that no human eye is quick enough to see that lightning blow strike home, and no ordinary camera can record it. Some indication of the speed of the gaff may be gathered from the fact that a cock has been known to drive its steel-mounted spur half-an-inch into a seasoned oak board.

In addition to moving parts of their bodies at high speed, many animals are also capable of hurling themselves into action in a very short space of time. Marcus Daly, a professional big-game hunter with great experience of the carnivora, says a game-eating lion will kill a buffalo, zebra, eland or other game in less than half a second.

A famous correspondence took place in the columns of the *London Times* in 1931 on the acceleration attained by certain large animals. The well-known big-game photographer, Marcuswell Maxwell,

The flick of the toad's tongue is too fast for the human eye or the ordinary camera. It is believed that it takes less than one-fifteenth of a second for the tongue to flick out, gather up insect or worm and disappear with the swiftly gathered meal.

wrote that he had been charged by a gorilla, which had leaped from a tree. Maxwell estimated that the animal had covered fifteen yards in less than a second (and any experienced photographer, such as Maxwell, knows that a second is a long time).

A subsequent writer in the correspondence challenged such an estimate, but Maxwell stuck to his figures and gave his reasons. Other people, with experience of the amazingly quick movements of wild animals, supported him. Someone who had spent years in Africa wrote: "From my own experience I should say that a leopard could cover fifteen yards in a second, springing from a standing start. They move literally like lightning."

But super-gymnast though he undoubtedly is, I should award the palm for sheer speed from a standing start to the cheetah, the finest sprinting machine Nature has so far produced. The acceleration of a prime cheetah is such that it is believed to be capable of attaining a speed of forty-five miles an hour from a standing start in two seconds. When in full stride it can cover 103 feet per second, or seventy miles an hour—some observers would say even faster.

I think it is of interest to compare such speeds with those of a first-class human sprinter. In two seconds he can reach a speed of only sixteen miles an hour, and when going absolutely all-out—in the middle of

The strike of some poisonous snakes is very rapid. The late Raymond Ditmars wrote: "Stroke, bite, pressure on the poison glands, injection of the venom and return of the head to the snake's defensive position normally take less than ½ second."

the 100-yard sprint—he can reach only twenty-four or twenty-five miles an hour.

But it is not only the larger and more spectacular mammals that possess such remarkable powers of acceleration. Lizards are experts in flashing into action, and, equally, in coming to a dead stop after a lightning burst. Alfred Mosely tells of coming upon a monitor fast asleep in the Kalahari Desert. He got within a yard of the large lizard and then clapped his hands. Then "there was no sign of the animal but simply a streak of dust right away to the horizon."

But for all their rapidity of movement these land animals are still behind birds and insects in the execution of the lightning maneuver. Have you ever thought what must be the acceleration of birds that crouch in the roadway before your speeding car and wait until the last split-second before they make their getaway? I worked out the time factors involved in one such incident and came to the conclusion that a robin attained a speed of twenty-five miles an hour in about one-twelfth of a second!

The perfect ease with which birds of prey sometimes capture their quarry are illustrations, not only of extremely rapid movement in Nature, but also of wonderful co-ordination of eye, wing and talon. A sparrow-hawk has been seen to swoop over a pond and pick off a swimming (Continued on page 551)

"Juniper," the Versatile White Cedar

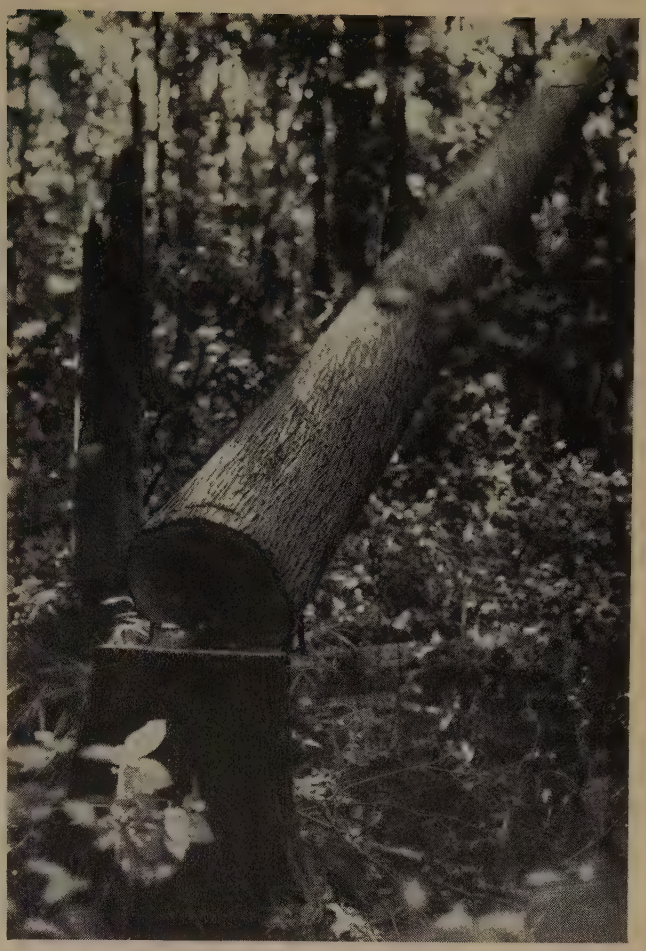
By GAIL JARVIS

THE first valuable cargo sent from colonial Virginia to England was a shipload of cedar logs. History relates that the gold-seeking colonists found a glittering yellowish dirt soon after their arrival on these shores, and they filled the hold of the first returning ship with this highly-promising but actually worthless stuff. Enthusiasm for their discovery had not died by the time the second ship was ready to depart, but, for some unrecorded reason, the captain could not be persuaded to ship this likely-looking dirt. Instead he loaded his vessel with sturdy cedar logs, and took them to England, where he sold them, doubtless at a handsome profit.

History fails to reveal the exact variety of cedar logs that the stubborn captain took with him. There is an excellent chance that they were southern white cedar, since the tree grew in abundance in the Jamestown area at that time. We like to think that someone recognized early the value of this tree. It has played an important part in American life from colonial days to the present time.

It acquired many names along its range on the Atlantic coast from Massachusetts to Florida. Anyone trained in silviculture would immediately recognize it as *Chamaecyparis thyoides.* In early times it was often used for fence posts in Delaware and Pennsylvania, so the common name became post cedar. Because of its preference for swampy places it is sometimes called swamp cedar. In other localities it is called southern white cedar, to distinguish it from northern white cedar, or arborvitae. Deep in the Dismal Swamp of Virginia and North Carolina this tree is always called juniper. Another cedar, *Juniperus virginiana,* grows in the swamp, and one might expect it to receive the name, but common names are strange things. From the black man in high rubber boots who wades in the swamp to fell the tree, to the master boat-builder of the nearby navy yard, the southern white cedar is always known as juniper. That it is not entirely a local name is shown by the fact that shingles of this wood, sold in Philadelphia in 1750, were called juniper shingles. No less authority than Webster's dictionary confirms this term.

From the time the first English colonists landed on American shores to the present, this tree has played an important and varied part in the lives of Americans. Even in pre-Revolutionary days, when the tree could be found all along the coast, juniper was popular for yards, topmasts, booms, and bowsprits for boats, as well as for shingles, poles, and fence posts. Some of the earliest New Jersey homes were constructed entirely of this wood, and citizens of Philadelphia preferred juniper shingles to all others for the roofs of their houses. It is said that builders of houses in that city were criticized for constructing houses in such a flimsy manner that the walls would support no heavier roof than that made of this extremely lightweight cedar. The market for these feather-weight shingles extended farther than to just this one locality. Shipping records show that shiploads were sent from both Norfolk and Elizabeth City to the West Indies, not long after the Revolution.



A giant juniper falls in the Dismal Swamp, where it is making virtually a last stand. Originally it was plentiful all along the Atlantic coast, from Massachusetts to Florida, and a valued timber tree.

A tale is told of the great Gottlieb Mittelberger, who slept under a roof made of juniper shingles while on a visit to America. The pattering of the rain on the roof was so musical that he tried the wood for making organ pipes, and pronounced it the finest for that purpose in all America.

Oil tanks made of juniper were highly esteemed by early dealers in whale oil. In addition to its very light

Juniper logs from the swamp loaded for the trip to the saw mill. Logs long submerged in swamp waters are still good and sound for varied uses.

weight, it had the further advantage of being so dense that seepage was exceedingly small. Many other items, such as tubs and churns for butter, pails for carrying water, kegs and firkins for packing fish and meat, and boxes for cheese, were often made of juniper because of its weight. Water mains of juniper were common in colonial times.

It was not only the durability and cheapness of the wood that made it so highly prized as a water carrier. There has long been a belief that juniper wood exercises some refining influence on water. Some people believed that juniper water mains would purify the water flowing through them. Others used a water bucket of this wood, while a spigot made of juniper was sometimes believed to have the same sterilizing effect on the water. Ships putting to sea from the Dismal Swamp area often made great effort to fill their water casks with "juniper" water, since it was commonly thought that standing trees somehow purified the swamp water.

The juniper tree certainly has an effect on the water of the Dismal Swamp, even though it may not be a medicinal one. The swamp water is a beautiful amber color, and has a fresh and inviting taste. This highly-colored water is found everywhere in the swamp itself, as well as in the great canals that run through it. Boys diving in the water of Dismal Swamp Canal in summer send up splashes of what looks like a strong brew of clear coffee. Perhaps the resemblance to a beverage accounts for the "juniper tea" of years ago. Old-time lumber camp cooks used to brew a strong concoction from the bark and heartwood of the juniper, and dole it out as a sure preventive for malaria.

It is now generally believed that the color of the water is due to the leaching of the thousands of submerged logs that lie in the swamp. Many deeply-buried logs have been found in areas where the water has been drained away. At one time the business of "mining" juniper logs was a profitable one, since the trees are in good condition even after being buried for hundreds of years. The wood is sufficiently sound to be made into shingles, or other lumber, and, oddly enough, it retains its characteristic cedar odor after all the years.

This ability to resist decay when submerged in water makes juniper a valuable wood today. Many boat builders believe it to be the finest wood for planking small boats. It never becomes waterlogged, and it is little affected by dry rot. It offers poor fodder for the shipworm of tropical waters, so this scourge has a tendency to avoid boats planked with juniper. As a matter of fact, a boat planked with juniper will last an almost indefinite time. Previous to the present war, almost all the small boats, such as motor boats, gigs, and barges, built for the Navy in the Norfolk Navy Yard, were planked with this fine wood. Unfortunately the increased need for boats has resulted in a depletion of the supply of juniper lumber.

Juniper has the further advantage of being the only boat lumber that comes from the saw mills with the bark on its edges, and therefore the board tapers in the manner of the tree from which it was sawed. Curved planks can be sawed having the grain parallel to the curve of the plank.

Although the juniper tree could once be found all along the Atlantic coastal area, almost the only good stands now available are found in the Dismal Swamp. There, in virtually inaccessible juniper bays, may be found great numbers of this excellent tree. Doubtless it is the natural barrier of the swamp that has caused these trees to be saved for this generation of users.

Moose-Bush Blossoms

By OSCAR OSTLUND

Through startling fragrance, more than sweet,
The reawakened senses meet,
A thing of earth and heaven spanned—
A flower perfumed by an angel's hand.

Nature Adorned the Indian Tepee

By ELLSWORTH JAEGER

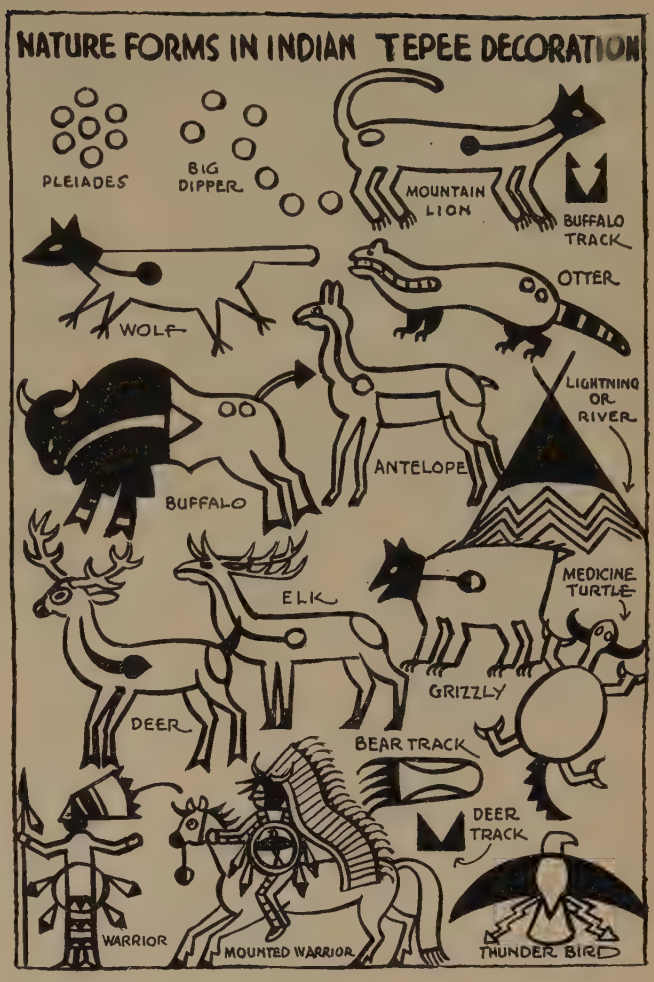
Illustrated by the Author

THE tepee of the Plains Indian was one of the finest outdoor shelters ever devised by man. It was of conical shape, made of buffalo or deer skins, held up by a tripod-like structure of twelve to fifteen poles. Movable flaps at the top enabled the Indian to have a fire inside, the smoke flaps helping to draw out the smoke.

The tepee's origin is not known, although some authorities consider it a recent invention. Some tribes believe it was discovered by a man who twisted a cottonwood leaf into a cone shape and used this as a pattern. This may be only a story, although children of the Plains tribes made model tepees from cottonwood leaves.

The early lodges were constructed from buffalo cow skins. In the spring, when the new lodges were set up, they resembled so many glowing Chinese lanterns, the fire light showing through their painted sides. The Indian lodge always faced the east, so that the first rays of the morning sun could enter the doorway. Then, too, the prevailing winds were from the west, and the smoke flaps would best function with the lodge facing the east.

The tepee was not only a home, but a shrine, as well. There were sacred times when the occupants meditated and prayed before tiny altars and sacred fires within their lodges, and no one entered. Mystical, supernatural and sacred symbols were painted on the lodge, many of these medicine paintings being symbolic Nature forms. Medicine, or dream animals, birds and other creatures, as well as conventionalized Nature forms, such as the earth, sky, astral bodies, vegetation, lightning, rainbows and such, were used as decoration. Often the owner's totem was painted on the lodge.



Some tepees were thought to have special powers. Mad Wolf, a chief of the Blackfeet, owned a "snow tepee" that was said to possess weather medicine. The Great Bear or Dipper, a cluster of seven stars, was painted on the north side, the direction from which the blizzards came. The top was painted yellow, symbolic of the sunrise sky, and four claws of the thunderbird were drawn on four sides of the lodge.

A medicine man of the North Piegans of Alberta, Canada, had a "thunder tepee." Its top was black, representing a cloudy or night sky, and there was a

cross as the back for a dream symbol. Four red bands circled about the center of the lodge. These were the tracks of the thunderbird or lightning.

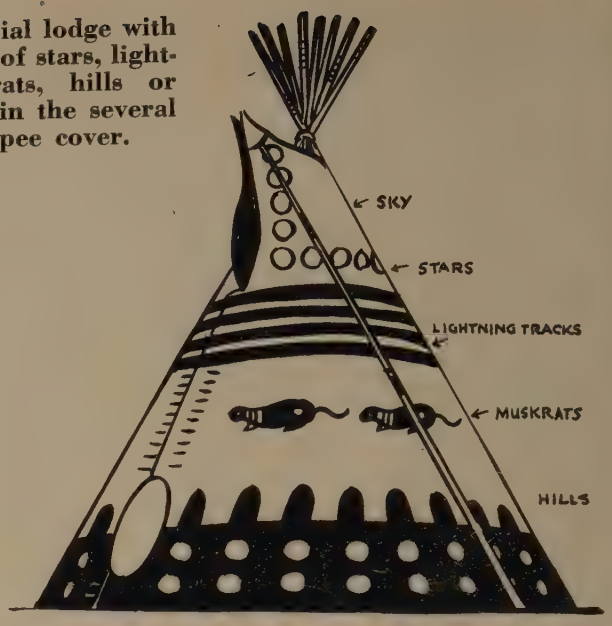
Another "thunder tepee" had, at the back, a figure of the thunderbird perched on a red ball—a thunder bolt —with lightning flashing from its talons. A black top represented the storm sky. Beneath was painted the arch of a rainbow, a crescent moon and the morning star in blue. The lodge was thought to serve the village as a protection from storms.

In one village a "fair weather tepee" was painted in blue. The top was darkest blue, shading to light blue near the ground. Invocations made in this lodge were thought to clear the sky of the wildest storms. Painted on the back of the lodge was a yellow disk, divided in half. The northern half was covered with dots representing hail, the southern half rain. Above the disk a thunderbird with outstretched wings was painted, with lightning zigzagging from its beak.

Many Indian tepee covers were divided into three areas, (1) the top or sky, (2) the above-ground area, and (3) the ground itself. Within these areas various natural forms were painted. In the sky section many astral bodies were designed. In the middle part of the lodge cover, on the *above the round area,* animals, birds, plants, trees and other forms of living things were placed. Often mountains, birds and rivers also were depicted on this section. The base or ground area was sometmes covered with symbols of fungi.

The upper, or sky, part of the tepee, often colored black or blue, was sometimes covered with large white dots. These represented stars. Sometimes such star groups as the Big Dipper, the Pleiades, and other constellations that played important roles in the mystical and legendary life of the Indian, were painted on the tepee top. Again, a number of parallel stripes appear on the lodge cover. These symbolize lightning tracks or rivers.

A Blackfoot ceremonial lodge with its symbolic painting of stars, lightning tracks, muskrats, hills or buttes and puffballs in the several sections of the tepee cover.



The drawings show the Pleiades and Dipper star designs, and various animals, such as buffalo, otter, wolf, deer, elk, antelope, bear, turtle, crow and thunderbird. At times the Indian pictured himself on his lodge, painting a mounted warrior or a warrior on foot. A Sioux tepee at the American Museum shows a wolf design, with a row of mountains and trees above the ground area.

Animal tracks, such as those of the bear, deer, and buffalo, were sometimes painted on the lodge cover. The Indian, living close to Nature, has always been a lover of Nature and a close observer of her many moods. The habits of the living creatures about him, the voices of the winds and waters, the flickering shadows, the mystic radiance of moonlight all appealed to him and influenced his thought. Gradually he gathered within himself fanciful reasons for the myriad manifestations of Nature. A poet by instinct, he formulated delightful legends, and painted equally fanciful symbols of his every-day life, of supernatural creatures and of his gods.

Nature Paints with Fungus

By E. N. EKDAHL

NATURE seems often to have a sense of humor and a sense of the appropriate. I was sure of this when I came across a cypress board, four inches by thirty and one-quarter inches. In some manner the board had developed a fungous growth that has prospered in an astonishingly artistic way. And, appropriately enough, Nature, painting with a fungus, had chosen to picture a cypress swamp. She had used a large canvas, for the picture extends the length of the board, although the photograph here shows only about one-third of the board and its landscape. The "artist" even put in reflection in the foreground water.

To use this map hold it before you in a vertical position and turn it until the direction of the compass that you wish to face is at the bottom. Then, below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. It will not be necessary to turn the map if the direction faced is south. Time given is Standard Time.

The Coronagraph

By ISABEL M. LEWIS

On Fremont Pass, near Climax, Colorado, at an elevation of 11,500 feet, is a unique observatory built by donations from private individuals on a site given by the Climax Molybdenum Company. Its purpose is to study the solar corona by means of an instrument known as the coronagraph. Although Dr. Harlow Shapley of the Harvard College Observatory is nominally the director of this observatory, Commander Donald H. Menzel and Dr. W. O. Roberts have had most to do with its erection and with carrying on its work. So important did this become during the war that the coronagraph, which is a special type of telescope, was regarded as a secret instrument of war and the observatory was closely guarded.

It has long been known that there is a close correlation between the sunspot cycle of solar activity and the form and extent of the solar corona, that strange, ethereal solar envelope that is seen in all its pearly-white splendor only when the glare of light from the sun is temporarily blotted out by the moon at the time of a solar eclipse. The corona itself is composed of an inner corona, a thin, yellowish ring lying directly above the photosphere or visible surface of the sun, and the much fainter outer corona, which changes so noticeably in form with the sunspot cycle, and which, at times, has streamers extending to several solar diameters from the sun. It is chiefly the light of the inner corona—which, at best, has an intensity less than that of the full moon—that is studied by means of the coronagraph.

Many photographs of the corona, taken during solar eclipses, show coronal arches, or petal-like formations, over conspicuous solar prominences. There appears to be a close connection between these prominences and coronal rays and streamers, as well as with

sunspot activity. Moreover, all these manifestations of solar activity—sunspots, eruptive prominences, and coronal rays, arches, and streamers—are in some way associated with magnetic storms upon the earth, and disruption and temporary blotting out of radio and telegraphic communications upon the earth. Streams of electrified particles from disturbed areas on the solar surface, generally in the vicinity of sunspots or great eruptive prominences, penetrate the earth's upper atmosphere. They affect the strata known as the ionosphere in such a way as to interfere with these vital means of communication. The fact that, through continuous observations of these areas of unusual solar activity, the occurrence of magnetic storms and temporary blotting out of such communications can be predicted in advance has made the study of all forms of solar disturbances of the greatest importance in time of war. Any action depending upon uninterrupted communications could be postponed at such times, or an opportunity might be presented to attack the enemy when his communications were temporarily paralyzed. These magnetic storms and their far-reaching effects are most prevalent during sunspot maximum periods, and they occur much less frequently during a sunspot minimum period, such as that through which we have just passed. They should occur in increasing number and intensity during the approach to the next sunspot maximum period, which will take place several years from now.

The corona emits an abundance of ultraviolet energy and soft X-rays, and these emissions, encountering the ionosphere, are instrumental in producing magnetic storms and disrupted communications, and, at times, unusual auroral displays. Sunspots have been credited with producing effects that may arise, instead, from emission of coronal streamers from these regions in more than usual intensity. Although the corona is very low in density, containing little mass in all the enormous volume of space it occupies, it is tremendously hot. The temperature of the center of the sun runs into millions of degrees; that of its surface is 6000 degrees Absolute.

The great eruptive, gaseous prominences have temperatures as high as 30,000 degrees Absolute, but the highly rarefied gases in the solar corona have a temperature as high as 1,000,000 degrees. How such a temperature is maintained is a mystery. It has been suggested that the breaking down of the atom may produce it, or, again, that it may come from the eruption of intensely hot gases from far beneath the solar surface. The light of the corona, which is less than that of the full moon, is about 600,000 times less than that of the surface of the sun. It is because it is so extremely faint that it has been impossible to observe it, except at times of total solar eclipses, when the light of the sun is temporarily blotted out by the moon.

For many years attempts had been made to photograph the corona without an eclipse, but all efforts failed because of the blinding glare of sunlight that concealed it. Finally, M. Bernard Lyot invented his *coronographe*, a telescope in which the glare of sunlight was greatly reduced by reflecting disks. He succeeded in obtaining, six years or more ago, several photographs taken from Mt. Pic Du Midi in the Pyrenees. These showed some of the features of the inner corona. The Harvard Coronagraph now in use at the observatory on Fremont Pass is modeled after the original *coronographe* of M. Lyot. During the past four years this instrument has taken millions of photographs of the region of the inner corona. These have been carefully studied to determine the effect of coronal emissions upon the earth's atmosphere, radio reception, and the weather.

The coronagraph operates upon the principle that it will be possible to photograph, and view directly, the solar corona if the scattering of sunlight by the earth's atmosphere—as well as scattering of light within the telescope itself—can be screened off by reflecting disks and filters. Dust, which scatters light, is also a most disturbing factor, and difficult to eliminate. By choosing a high elevation in a wooded region the glare of sunlight and the number of dust particles are greatly reduced. Filters play a very important part in the development and use of the coronagraph. A new type of filter has been designed by J. W. Evans of the University of Rochester by means of which direct photographs of the corona may be obtained rather than of its spectrum. The present filter is a monochromatic polarization interferometer and sunlight is greatly reduced by it. A special Eastman film, sensitive to light of one color only, now records the spectral lines of the corona. Newly-designed filters will still further reduce the light of the sun and improve the instrument. At this observatory, the highest in the world, photographs are taken with the coronagraph on every clear day, and it is expected that before long it will be possible to make long-range predictions of changes in radio transmission caused by observed changes in solar prominences and corona. In time one may even glimpse visually some of the glory and splendor of the solar corona as it appears when the light of the sun is blotted out completely by the friendly moon.

A total eclipse of the moon, visible all over the North and South American continents, as well as Europe, Africa and parts of Asia, will occur on December 18-19. In Eastern Standard Time the moon will enter the earth's (Continued on page 553)

The Daylight Moon

By RUSSELL PETTIS ASKUE

Whenever our pale satellite
Forgets that she belongs to night,
I hear observant children say
"Oh what a pleasant moonlight day!"

IMPENDING TRAGEDY IN IN THE ADIRONDACKS

(Continued from page 537)

attraction of tourists who delight in a vacation land in which the deer and other animals are plentiful. This is a value which constantly increases down through the, years and represents an enormous economic value to the state and the community. To substitute a land of lakes and forests and rivers with millponds surely is of no economic advantage to the communities which are already blessed with an abundance of waters and power.

"In the case of the Higley Mountain reservoir, public hearings have already been held, certiorari actions dismissed and the Black River Regulating District is ready to go ahead with the project. The public hearings on the Panther Mountain project are expected to be held shortly.

"It may thus be seen by this brief summary of the situation that with the completion of these proposed reservoirs, the Adirondacks will lose, in a single, devastating stroke, its largest deer wintering grounds, the heart of its most extensive wild area, substantial forests and probably the best hunting and fishing area in these mountains.

"An imposing number of statewide organizations have already gone on record against one or both of these proposed reservoirs and include such organizations as the Adirondack Mountain Club, the Izaak Walton League, and others. To date, however, no united action by these or other groups has occurred.

"Immediate action by the leaders of existing organizations to form a statewide committee which could spotlight the issues involved may be the only action which can save the Moose River region from destruction."

Bird Poems Wanted

Judging by our mail, there is no dearth of poems about birds, but jointly the Robert Sparks Walker Audubon Society and the Elise Chapin Wildlife Sanctuary of Chattanooga, Tennessee, are seeking to stimulate the writing of more poems about birds. To that end they offer $100 in cash prizes for bird poems, not exceeding forty lines in length, submitted in sealed envelopes not bearing the name of the author on the outside. The prize winning poems become the property of the donor of the prizes and may be used for book publication. None will be returned without return postage, or no questions answered unless a stamped return envelope is enclosed with any query. The contest closes March 1, 1946, and the poems should be submitted to Madeline A. Walker, Triple Tree Tangle, 808 South Greenwood Avenue, Chattanooga 4, Tennessee.

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The School Page

Edited by E. LAURENCE PALMER

Professor of Rural Education, Cornell University
and Director of Nature Education, The American
Nature Association

MAKING TRACKS ATTRACTIVE

It is a pleasure to write these School Pages, but it is rarely that I have written one with more enthusiasm than this one. The difficulty is not one of getting ideas to put in but of selecting which ideas must be kept out.

A good lesson must be based on something that is universally available for study. It must be interesting, practical, not necessarily an end in itself, and must never be wholly satisfying. I know of few fields of Nature study that can approach the study of tracks in fulfilling these requirements.

Tracks are universally available. In our youth we are told not to "track up" the newly mopped kitchen floor. We can find excellent tracks for study in mud, sand, snow, ice, concrete, and even in loosely piled leaves. They are available summer and winter, in cities and in rural areas, in simple or in complicated forms. We may use them to find a rabbit, a lost child, an escaping thief, or to understand the locomotion and habits of an animal that may have been extinct for millions of years.

Here are a few simple ways of adapting track studies to the more or less orthodox activities of the schoolroom.

The art teacher may see something of beauty in the repeated series represented by the tracks of a running rabbit. She may convert these into a design for wall paper, a pattern for stamping cloth, or for some other conventionalized use. One of the most attractive suggestions I ever saw for wallpaper for a child's room had conventionalized rabbit tracks running up the walls, with a frieze of rabbits sitting along the upper border. A similar design used the tracks of cats, with cute kittens at the top.

The arithmetic teacher may wish practical exercises in making measurements. When a youngster reports on tracks he may have seen, he should be able to say, with some accuracy, that the animal took leaps of more or less specific lengths, and these should be significant in making an interpretation. About the only way to form a personally considered judgment is to get the habit of measuring tracks as they are found from time to time, of saying that this track is more than an inch across and therefore, in all probability, is not that of a house cat. Practice in making these kinds of studies develops judgment and skills.

The geography teacher will search far and wide to find anything better than the study of tracking to use as an introduction to mapping. A report on a track should provide information as to the direction the animal was going; follow the changing directions taken by a pursued or pursuing animal, as evidenced by its tracks. Such data call for excellent practice in recording and in interpreting compass directions. How can a child who cannot map the story of a wandering red squirrel, as told by its tracks, really understand the idea back of making and reading maps?

The language teacher should welcome the stimulus supplied by the questions raised by examination of a set of tracks. Two or more children may be asked to write their interpretation of the story told by tracks in the school yard. There will be differences of opinion that may be defended or opposed, and the resultant argument may well be directed along the lines of adequate and proper expression. Imagination will be stimulated by these attempts at interpretation, and, believe it or not, imagination is essential to all worthwhile human endeavor. Even the physicists who developed the atomic bomb, by the use of most exact procedures, must have had the imagination to envision what would happen under the conditions they were able to set.

The social science teacher should be interested in human relations. Boys in a class may be interested in the harvesting of the raw material for fur garments hoped for by the girls. Economic production of a fur supply depends on a sustained yield that can be regulated to some degree by track studies. If the immediate value of furs is not interesting to the social science teacher, who feels she must speak of what happened in the dim dark ages, then the history of the fur trade from an earlier day, down to the tracks made last night along a neighboring creek, can make a story that touches not only on the prosperity of individuals but of nations as well.

The physical education teacher may see some significance in the fact that, while rabbits running over the ground usually use their front legs alternately, the climbing squirrels must exert more power in making a climb and commonly place their front feet on the ground simultaneously, as shown by the tracks. The physics of this may appeal to the physics teacher, just as he may see some significance in the fact that a tree-climbing deer-mouse, which must balance itself well, has a tail much longer than that worn by the ground-haunting meadowmouse. Even the folklore lover may be intrigued, in this connection, by the wisdom of the farmer's wife, who cut off the tails of the three blind mice, thus making it impossible for them to climb about the pantry as well as they had in the past.

At the high school level, there must be a few biology teachers who recognize that ecology is a living subject, not just another chapter in a text book. To these, the appropriateness of tracks in different environments will offer a certain appeal. If the placing of mink tracks along a stream, and a duck track on a lake shore, does not call forth some worthwhile studies on the appropriateness of certain structures for meeting certain requirements, the teacher should not be teaching biology. Just take a glance at the pages of track pictures shown in the insert in this number of *Nature Magazine*, and, without taking the time to check on the names of the animals responsible for them, try to read into each track some suggestion as to the normal habitat of the animal. Then check on the animal's identity and see how rational your judgment was. Among the tracks of the birds, notice how the scratching birds, as a rule, do not show tracks of the hind toes, which would be in the way were they placed on a level with the other toes. Then, too, notice how the perching birds have well-developed and well-placed hind toes, which, because of its position, can grasp the customary perch firmly when this is necessary. The possession of webs, flaps and partial webs on the feet of birds and mammals are usually recorded in the tracks, and are helpful in interpreting behavior, habitat and other important things. The fixed hooves, webbed feet, retractile and non-retractile claws of the mammals all have significance.

In short, one must see in the study of tracks an ever-varying series of new situations, set up in a variety of places and offering a variety of rewards for a valid solution. What more can any teacher ask of any field of study?

Neighbors who have been to the ends of the earth during the war may have seen examples of extraordinary tracking feats by scouts. While the crudest observer may recognize tracks in the snow made by a skidding automobile, there are men who can, with surprising speed and accuracy, follow the trail of another man, or of an animal, over a terrain covered with leaves, grass, brush or other kinds of vegetation. It is quite possible that some of these returned travelers may be willing to help enrich local studies by reporting incidents that were of life and death importance in regions fortunately now far remote. It is doubtful that the average youngser will be able to recognize signs that are glaringly significant to the experienced tracker, but neither is there any doubt but that he can improve his skill in this direction. If we must be dramatic, there is every possibility that this may be important, some time, in tracking down a local malefactor.

In the special insert, on pages 529 to 536 of this magazine, we have given some suggestion as to the value of track study as a hobby. To the writer, a hobby interest alone would justify any necessary expenditure of time and money to pursue it.

THE SPLIT-SECOND IN NATURE

(Continued from page 542)

moorhen without even making a splash. An American sparrow-hawk in rapid flight was seen to pick off a lizard from the trunk of a tree without pausing in its flight. A peregrine falcon, or duck-hawk, will sometimes gather up a small bird so neatly and swiftly that no alteration in its flight and no act of seizure can be detected.

But it is not only in the taking of life that birds of prey execute the lightning maneuver. Often their dashing tactics lead them into situations where only the quickest instinctive action can save them from serious injury or death.

A correspondent of mine told me a remarkable exhibition of avian aerobatics he had witnessed when a sparrow-hawk was chasing a finch. The small bird was already crying out in the black minute before capture, when it managed to save itself by diving under a large wall of telegraph wires and found sanctuary in some scrub. The hawk, with no eyes for anything save its victim, suddenly found itself hurtling into the bank of wires, which would have cut it to pieces at the rate it was traveling. To save itself, the hawk shot straight up into the air like a rocket, turned into a half-loop, rolled over at the top of the turn and flew back the way it had come. Incidentally, this particular maneuver is known to airplane pilots as the "Immelmann turn"—named after the German aviator who first practiced it in World War I.

I am not certain whether the following action of a sparrow-hawk should be interpreted in the same way as the incident cited above, namely as an intelligent, if largely instinctive, effort to save itself from disaster by the execution of a lightning maneuver, but the incident is too remarkable to be omitted here. It was told to me by an eye-witness.

A sparrow-hawk was flying low down a forest road. At the end was a five-barred gate. Waiting by the side of it was a keeper with his gun trained just above the top of the gate. (Sparrow-hawks are shot by keepers in England because they are believed to prey on game and game-chicks.) But as the hawk reached the gate, instead of flying over, it flew *through*, between the fourth and top bars of the gate! Did the hawk, as it came to the gate, catch a lightning glimpse of the waiting keeper, and, with a speed of reaction and muscular co-ordination that baffles understanding, take the only course that could save its life?

Despite their extreme agility it is not birds but insects that are the supreme masters of maneuverability in the air. The late Professor A. Magnan of the Collège de France used ultra high-speed motion pictures to study insects in flight. He obtained film records taken at nearly 30,000 pictures a second (not a minute!) and then, when the films were developed, he had the tiny images drawn on paper on a larger scale. It was then possible for him to analyze aerial movements that it would have been impossible to appreciate by any other means.

In his remarkable book, *Le Vol des Insectes*, dealing with his researches and telling of the wonderful things he found out about the wing-beats, speed of flight and general aerodynamics of insects, he has the following passage about the aerial maneuvers of a hover fly. The following is a free translation of what Magnan wrote:

"With the hover-fly, *Chrysotoxum arcuatum*, one sees the creature perform on the spot real turns in full flight, so well that at a given moment the insect is found with its feet in the air, its back underneath. In the same way, I have observed in the natural flight of a fly, the performance of a veritable somersault such as aeroplanes do not make. She first takes up a normal position, with the abdomen and feet below, then she quickly makes a rotation of ninety degrees round the axis of her wings, to find herself with body vertical, abdomen below, all the time flapping her wings. At length, after a new rotation of ninety degrees, it is the abdomen and feet which are turned uppermost, wing-beats continuing as usual.

"It is worth noting that the changes are often sudden and happen in a very short time, somewhere about one thousandth of a second, the somersault, for example, taking place in one hundredth of a second."

Think of it—a loop-the-loop in one hundredth of a second! There could hardly be a better example of the split-second in Nature than that.

Insect Essay Contest

Two prizes, founded by the late Dr. William Johnson Walker, are offered annually by the Boston Society of Natural History for the two most acceptable papers written in English on a subject chosen annually by the Society's Board of Trustees. The subject selected for 1946 is insects. Details of the contest, which closes May 1, 1946, may be obtained by sending a stamped return envelope to Miss Margaret Baker, Boston Society of Natural History, 234 Berkeley St., Boston, Massachusetts. The subject for 1947 will be in the field of fungi.

Illick Named Dean

Acting dean since 1943, Dr. Joseph S. Illick has been named dean of the New York State College of Forestry at Syracuse University. Formerly state forester of Pennsylvania, he joined the college staff as special lecturer on sylviculture in 1931 and soon became head of the department of forest management.

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MINERALS THAT TAKE THEIR OWN "PICTURES"

(Continued from page 522)

or longer. Thus one should not conclude in a day or two that the minerals are non-radioactive.

We are not all fortunate enough to have access to well-equipped photographic dark rooms, but there are usually one or two dark closets dark enough for photographic work, especially at night. The authors produced the accompanying illustrations while away from their laboratories in Northampton, working in a bathroom in their temporary residence in Cambridge, Massachusetts. A small, black, leather suitcase with fairly tight-fitting lid was used for making the exposures. This was done by placing, in the bottom of the suitcase, a small board with a flat surface, upon which a five by seven process glass plate was placed with the emulsion side up. The specimen, upon which a flat surface was previously ground, was placed with the ground surface in contact with the upturned emulsion of the plate. Dark cloths were placed over the specimens and the photographic plate to absorb any small amount of light that might leak in around the lid. The suitcase was left on the floor of the room in a corner, where it remained for the time required to make the exposure, the room being normally lighted and in use in the meantime. The reason for using a glass photographic plate with a board for support was to keep the photographic emulsion in as close contact with the entire surface of the radioactive mineral as possible in order to obtain sharp outlines of the configurations of the radioactive and associated minerals. This arrangement produced the sharp outlines shown in all the accompanying illustrations except the one containing the star. One may use a film instead of a plate, but frequently the film may become warped beneath the specimen and a fuzzy image will result. The plate, or film, is developed in the usual way to produce a darkened image of the areas covered by the radioactive minerals. In making prints the darkened images on the negative print white, giving the results shown in the accompanying illustrations.

The five pictures here represent autoradiographs of excellent specimens of several radioactive minerals from four well-known localities in the eastern part of the United States. These were made on process plates and printed on grade three glossy paper. Each autoradiograph is unique when radioactive and non-radioactive minerals are associated in the same specimen. One might aptly call each illustration the autograph of the particular specimen. There can be no forged autographs; each is unmistakably different.

When a dense material is placed between the radioactive substance and the photographic plate a shadow of the object is produced. The resulting picture is known as a *radiograph*. One of the illustrations shows the effect produced by placing a star made of sheet lead beneath a piece of massive uraninite. As the specimen is of an irregular shape, and without a plane ground surface to make a close and uniform contact with the photographic plate, its autoradiographic outline is represented by a halo, which fades away about an inch from the specimen. This is because the frequent collisions of the emitted particles with the molecules of the air prevented their traveling a great distance to expose the plate. The thin lead sheet made an effective screen to protect the photographic emulsion from the emitted particles.

From the Kinkle Quarry comes a rare and unusual mineral called cyrtolite, which ordinarily represents a variety of the mineral zircon. Cyrtolite usually contains a small percentage of uranium and thorium, in addition to the usual constituents of zircon. The Bedford cyrtolite, however, contains, in addition to the uranium and thorium, up to eight percent of the oxide of the very rare element hafnium. The configuration of the autoradiograph is indeed variable, and when compared with the more-or-less uniform appearance of the ground and polished surface of the specimen, it presents a most striking contrast.

From North Carolina, a state well known for the variety of its radioactive minerals, comes an interesting specimen of a mineral called samarskite, which is now in the mineral collection of Harvard University. This mineral frequently contains a variety of rare elements, among which are usually uranium and thorium. Other minerals containing more or less uranium and thorium may be intergrown with the samarskite in such a manner that on a polished surface the different minerals may not be distinguishable, while an autoradiograph will sharply outline the pattern of the various minerals of unequal radioactivity in the intergrowth. In making the autoradiographs there is a degree of exciting expectancy as to the configurations that some of the samarskite and other specimens will produce. The anticipation is much the same as that of the explorer anxious to see the configuration of the terrain beyond the next mountain ridge.

There are suggestions for the beginning amateur, in whom the lure of minerals, especially the radioactive ones, may have created a desire to collect these interesting and intriguing products of Nature. The first is to locate some member of the mineral club in your city, or in a nearby city, and find the location of not too distant mineral deposits, and get information on the mineral species to be found at each. The second suggestion is that, in the event one is especially interested in obtaining radioactive minerals suitable to use for the making of autoradiographs, the same mineral club member will undoubtedly be able to give advice concerning mineral dealers. They, at a nominal price, can supply several varieties of radioactive minerals capable of taking their own pictures.

IT'S AN ARMADILLO

(Continued from page 528)

last long," you think, but soon you see its back and rump clearing the surface, and finally it is swimming like a duck. This stunt puzzled the investigators for a while, but that was before they pulled the armadillo from the water and found its body swelled out like a toy balloon. The animal had gulped great quantities of air, thereby reducing specific gravity to the point where it was doing well. "Ingested air" the scientists called it, and chalked up another oddity in its favor.

These same investigators found out the armadillo was not such a bad fellow, either. They learned that while it had a taste for wild eggs, this was by no means its favorite food. Little crawly things were its main dish. From one stomach they painstakingly counted 3130 microscopic items of which 1200 were ants. There were 13,000 termites in another stomach; 150 caterpillars in the next one. Ninety-two percent of its diet was wholly beneficial to farmers and sportsmen. The rest of it, consisting of a few eggs and succulent fruits, like melons and tomatoes, did not seem like too high a price to pay for the services of such an indefatigable insect hunter.

Not only that, but the armadillo has helped pay its way by other methods not of its own choosing. The light-colored meat is considered by many as equal to pork in flavor. Mexicans are especially fond of it. On one ranch in DeWitt County, Texas, 300 armadillos were hunted down for food in a period of two months. A 4-H girls' club prepared 2000 No. 3 cans of armadillo meat in a single season, none of which went begging. Best known of all armadillo products is the shell. During a six-year period, when records were kept, dealers shipped more than 100,000 'dillo baskets and lampshades out of the South.

There is a limit to how far this busy little pick and shovel immigrant will travel into the United States. It does not like cold weather, and has already began to backtrack from some of the country it once occupied in northwestern Texas. Easterly, conditions appear to be more to its liking. Year by year it is extending its range toward the Atlantic states. How far it will come nobody knows.

ANSWERS TO "INE" QUIZ

1-w; 2-s; 3-o; 4-t; 5-i; 6-e; 7-n; 8-z; 9-j; 10-q; 11-g; 12-v; 13-d; 14-f; 15-k; 16-y; 17-h; 18-c; 19-m; 20-r; 21-a; 22-l; 23-b; 24-u; 25-x; 26-p.

THE CORONAGRAPH

(Continued from page 548)

shadow and the partial phase of the eclipse will begin at 7:38 P.M. on December 18; total eclipse will begin when the moon is totally immersed in the earth's shadow at 8:40½ P.M. It will remain entirely within the earth's shadow until 10:00 P.M. The partial phase will not end until the moon passes out of the earth's umbral shadow at 11:03 P.M. These same phenomena will occur one hour earlier in Central Time, two hours earlier in Mountain Time and three hours earlier in Pacific Time. During the total phase of the eclipse the moon does not disappear completely from view but shines with a dull coppery light. This is because it is illuminated by light refracted into the earth's shadow by the earth's atmosphere.

Among the planets this month, Mercury will be in inferior conjunction with the sun on December 7, when it passes into the morning sky. It will reach greatest western elongation on December 26, when it will rise about one and one-half hours before the sun and be visible above the southeastern horizon in the twilight.

Venus is low in the southeast at sunrise, and, viewed in the telescope, its phase is now approaching that of full moon. It will not be seen to advantage this month. Mars rises about three hours after sunset in Cancer, and is visible for the remainder of the night, a brilliant red object brighter than the first magnitude stars near it. Jupiter is now in Virgo, not far to the north of Spica. It rises five hours before the sun and is near the meridian at sunrise. Saturn rises in the northeast in Gemini this month, between two and three hours after sunset, and is visible throughout the night. On December 22 at 0:04 A.M., Eastern Standard Time, the sun will be at its greatest distance south of the equator and winter will begin in the northern hemisphere.

Chicago Nature Salon

Entries for the First Chicago International Salon of Nature Photography will be received up to January 10, 1946. The Salon is being held under the auspices of the Chicago Nature Camera Club, with the participation of the Chicago Horticultural Society and Garden Center. The facilities of the Chicago Natural History Museum have been made available for this exhibition, and the pictures accepted will be hung there from January 28 to February 28. Entries may be sent to the First Chicago International Salon of Nature Photography, in care of the Museum in Grant Park, Chicago. Photographs in the fields of plant life, animal life, scenery, gardens, anthropology are desired, color slides as well as black and white in each category.

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Under the Microscope

By JULIAN D. CORRINGTON

MYSTERIOUS HEART

THE ever-popular detective story attains its climax by exposing the heart of the mystery; the science student will find a romance fully as intriguing in attempting to solve the mystery of the heart.

Histology is a highly detailed study that at first view seems to be thoroughly explored, with everything understood and cut and dried; apparently all one has to do is to master the intricacy of fact and terminology. Only upon going somewhat deeper does it become clear that there are still many bypaths to follow and numerous gaps in our knowledge of the meaning of the structures seen under the lens. One of the best examples of this situation is cardiac muscle, the essential tissue of the heart, and hence one of the most vitally important materials in the body.

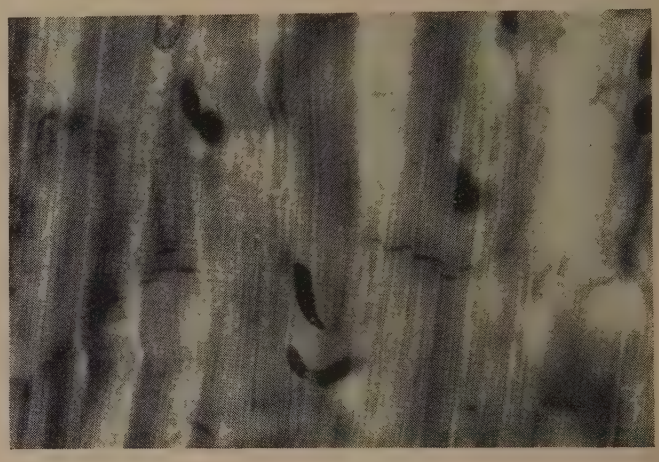
This type of muscle is likewise one of the most restricted tissues, being limited to the muscular coat of the heart (myocardium) and bases of the large arteries leaving the heart (aorta and pulmonary artery). It develops directly from the embryonic connective tissue (mesenchyme), which consists of irregular cells with tapering processes that hook up with those of neighboring cells with the result that there are no walls between adjacent cells. Such a tissue is not actually cellular at all, but is syncytial or makes up a *syncytium*, a word meaning "cells grown together." The fibers of adult cardiac muscle, as seen in longitudinal sections, are larger than those of visceral, smaller than those of skeletal muscle. They branch freely, and commonly there are slanting cross branches between parallel fibers, making H-shaped formations called *anastomoses*.

The syncytial arrangement of mesenchyme is retained by cardiac muscle and, since the territory of one cell grades into that of the next, without intervening cell walls, there is actually no such thing as a cardiac muscle "cell." The nuclei are prominent, oval, and central, contrasting decidedly with those of skeletal muscle. Unlike visceral but agreeing with skeletal muscle, cardiac is striated or striped, but the striations are less evident and not as complex as in skeletal muscle.

The finer structure of striated muscle, either cardiac or skeletal, as seen under high power, presents a checkerboard. Lengthwise each fiber appears to be separated into subdivisions termed fibrils, or myofibrillae; also each fibril has alternating light and dark bands, which seem to run crosswise of the fiber. Actually these striations are limited to the fibrils, between which is structureless fluid sarcoplasm. One part that does run entirely across each muscle fiber is a very fine partition, seen as a thin line in longisections, Krause's membrane, bisecting each light band of a striation. Best seen in skeletal muscle, a favorable preparation and very high magnification are required to demonstrate these membranes in cardiac muscle, but one of our illustrations shows them to excellent advantage in certain places. They mark off highly microscopic divisions of a fiber, known as sarcomeres—from one Krause's membrane to the next—and play an important role in various theories of muscle contraction.

Some authors state that there is no sarcolemma or investing membrane around the cardiac muscle fiber; others declare it to be present, but thinner than that around a skeletal muscle fiber. Finally, cardiac muscle, when stained with phosphotungstic acid hematoxylin, exhibits heavy dark bands, here and there, which run across or part way across the fibers, often

Cardiac muscle, l.s., 225X. Branching and anastomosing fibers. Below, intercalated discs and details of striation at 1500X.

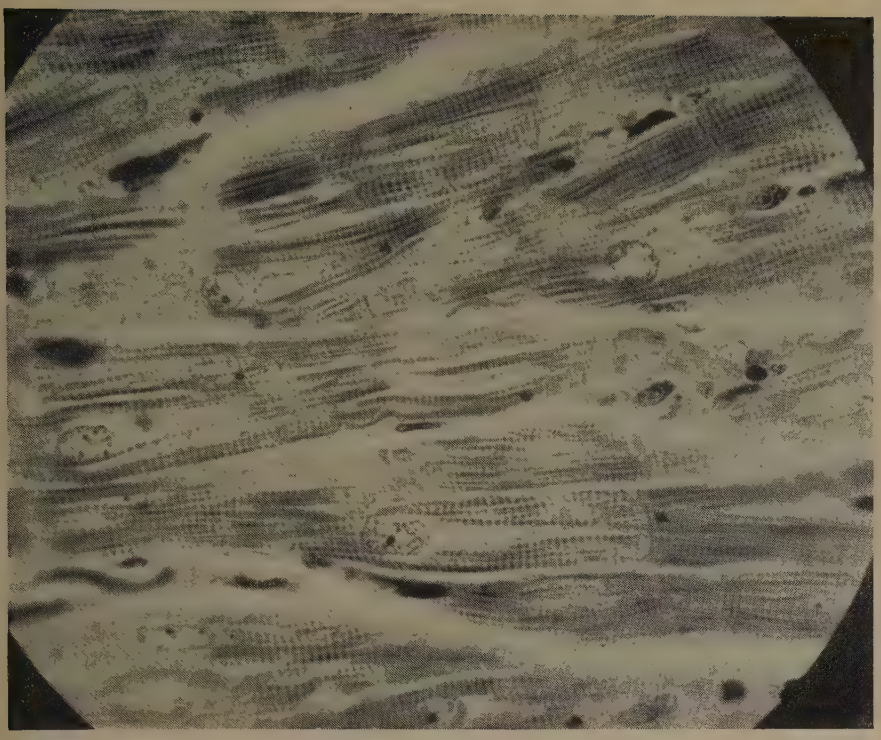


being arranged in a series of steps. These are called intercalated discs. In summary, cardiac muscle may be identified by having medium-sized fibers in the form of a syncytium, with frequent branching and anastomoses, large, central, oval nuclei, sarcolemma very thin, if present at all, cross striations, and intercalated discs.

Older theories of contraction were based on an interchange of fluid between fibers and interfibrillar spaces, or from one part of a fiber to another, as from the light band into the dark band, which thereupon became swollen, increasing its diameter but decreasing its length. Thus the matter stood until our day, the era of experiment, inaugurating many new forms of study that were destined to upset preconceived ideas.

First the existence of the longitudinal fibrils, so prominent in fixed and stained material, came under attack. They cannot be seen in many early embryonic muscle cells, are not demonstrable in living cells, and cannot be found in microdissections or in tissue cultures. Hence most histologists have concluded that they are not present as definite structures, but are optical effects due to unequal refraction of light rays in viewing fixed preparations, and express differences in tension resulting from contraction.

It had been observed that visceral muscle (this Department, October, 1943), which is not striated, contracts slowly; cardiac muscle, with striations, more rapidly; skeletal muscle, with more complex striations, still more rapidly; and the skeletal wing muscles of insects, with the greatest complexity of cross striations, most rapidly of all. It is still assumed, on this basis, that complexity of striations has something to do with speed of reaction, but further than that the meaning of the cross bands is not known. Embryonic heart muscle pulsates rhythmically before any striations can be detected, and, since isolated pieces of this muscle will contract independently, often with a dif-



Exceptional view of l.s. of human heart within a few minutes after death, 800X. Made with 4 mm. apochromat, 0.95 N.A.

ferent rhythm from that of the main mass, even the syncytial nature of this tissue has been questioned.

The intercalated discs were at first supposed to be cell walls, marking off the syncytium into definite cells; but then it was observed that many times they enclose non-nucleated portions, or that several of them may extend across a single nucleus. Next it was believed that they represented zones of growth from which new sarcomeres arise; later it was shown that they are infrequent in young hearts and increase with age, whereas the reverse should be true if this theory were correct. On account of this last observation, a third view looked on these discs as irreversible contraction bands, or evidences of contraction that happened to be caught by the fixative after death of the subject. A fourth conception states that transverse capillaries enter the superficial layer of a muscle cell-area and then degenerate, leaving empty cracks through which food and oxygen can enter, thus thinking of these discs as a nutritive device. A fifth view holds that pressure waves arriving from different points of origin and traveling along many pathways, crossing to other fibers via the anastomoses, clash or fail to meet accurately, and the discs represent fixed protoplasmic bands expressing such interference. There are still other theories, but enough have been mentioned to make it clear that we do not know the meaning of these structures.

The newer methods of study, then, have shown that a small, isolated piece of cardiac muscle will beat rhythmically when completely severed from all connection with blood vessels and nerves, when so small as scarcely qualifying as syncytial, when it is not possible to demonstrate the existence of fibrillae, and before the development of either cross striations or intercalated discs. There are theories on the nature and mechanism of contraction, but none of them are proven or capable of demonstration; we shall discuss these in a later article on skeletal muscle.

In spite of the fact that cardiac muscle begins beating almost as soon as a few fibers have formed in the early embryo and must continue to do so without rest or interruption as long as the life of the individual continues, that it is subject to many infections and failures, and hence a complete knowledge of its nature is essential to medical science; in spite of the thousands of researches that have adduced its intricate construction, shown here in great detail by the most advanced techniques of modern photomicrography, the two most important questions still remain unanswered:—by what machinery does muscle contract?—and, what is the meaning of the details of structure?

No, histology is no cut and dried science. Much remains to be discovered, especially in interpreting the significance of what is seen under the microscope. The heart, like other organs, is still mysterious, and withholds its secrets quite successfully from the prying eye and inquiring mind of humanity. There is still great need for research of the highest caliber, and opportunity to discover basically important facts and laws, all leading toward solution of that greatest of all mysteries, the nature and meaning of life and of the universe of which we constitute such an insignificant particle.

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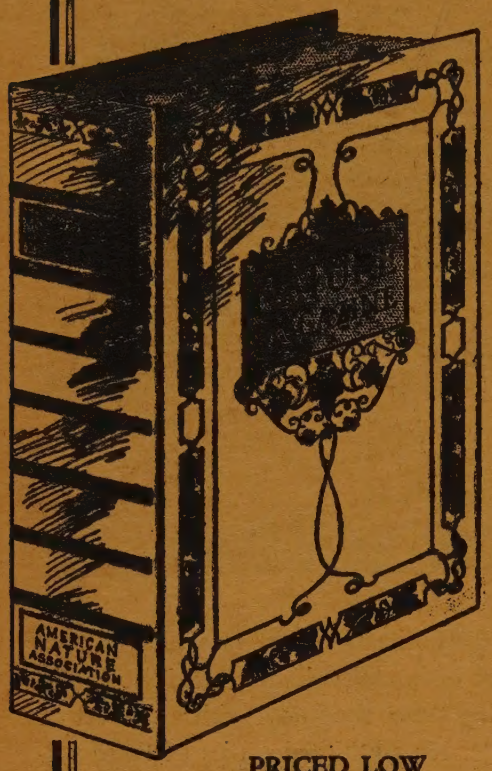

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